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LIST
OF
BOMBAY GRASSES
AND
THEIR USES

BY

J. C. LISBOA, J.P., G.G.M.C., F.L.S.,

FELLOW OF THE BOMBAY UNIVERSITY, MEMBER OF THE BOMBAY BRANCH ROYAL ASIATIC SOCIETY, MEMBER OF THE BOMBAY NATURAL HISTORY SOCIETY, CORRESPONDING MEMBER OF THE ACADEMIA REAL DAS SCIENCIAS DE LISBOA, MEMBRE DE L'ACADEMIE INTERNATIONALE DE GEOGRAPHIE BOTANIQUE DE FRANCE, FELLOW OF THE GEOGRAPHICAL SOCIETY OF LISBON, CORRESPONDING MEMBER OF THE MEDICAL SOCIETY OF LISBON, CORRESPONDING MEMBER OF THE ACADEMIA NACIONAL DE MEDICINA RIO DE JANEIRO, &c.

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PREFACE.

This list is, with some additions, a reprint of the papers on Bombay grasses read by me before the Natural History Society, Bombay. The following extract from the Preface, attached to the first paper read at the Society's meeting on 31st March 1890, will serve to give an idea of the manner in which the work was carried out:—

" *Gramineæ* is an order not so extensive as it is generally believed to be. It ranks third in the number of species, but its individuals are numberless. The study of grasses is a subject beset with many difficulties, the spikelets or flowers being small, nay often minute, and the glumes or floral parts of the same colour. Hence, to distinguish one genus or species from the other genera or species, it is necessary to examine the number of glumes, their relative size, their position, their conformation and hairiness, and other minute characters, which demand constant use of the lens and microscope. The subject is so difficult that in his Preface to the *Flora Australiensis*, the late Mr. Geo. Bentham, one of the most eminent English botanists, says :—

" ' *Gramineæ* have been the object of special studies of several of the most eminent botanists, amongst whom the labours of Brown, of Kunth, and of Trinius have been the most important. But the only general enumeration they have left is that of Kunth, who had not at that time the materials, nor yet the leisure to investigate the synonymy, which had already become exceedingly confused. This confusion has been gradually increasing by the large number of species described in partial works, without that general comparison which is especially needed in an order in which a large proportion of the species have a very wide geographical distribution, and it has become more especially involved through Steudel's more recent hasty and careless compilation *(Synopsis Plantarum Glumacearum)*. Nothing, therefore, is now more needed than a careful and judicious synoptical revision of the whole order. Such a one is now in progress for De Candolle's Monographs by my friend, General Munro, who has for a number of years made *Gramineæ* his special study, as well on living plants in tropical and temperate countries, as on dried specimens from the principal herbaria of the day, and in the correctness of whose views all those who have studied the partial memoirs he has published, feel fully convinced. Without his kind assistance the preparation of this part of my Flora would have been doubly laborious. He has, however, guided me throughout, and although

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I am far from holding him responsible for the generic and specific arrangement and characters here given, it is to him that I am indebted for many of them, and the whole has been the subject of discussion between us'."

The study is hampered from want of a general treatise on Gramineæ, or a complete book on the Indian grasses. It is true we have Steudel's "Synopsis Plantarum Glumacearum," published in 1855; but of this work, Mr. Bentham says the following in the Journal of the Linnean Society :—"The last general enumeration of *Gramineæ* was that of Steudel, who published in 1855 the first volume of his 'Synopsis Plantarum Glumacearum,' the worst production of its kind I have ever met with."

We have also Kunth's "*Enumeratio Plantarum.*" The first two volumes contain a description of grasses, which is, according to Mr. Bentham, far too hasty a compilation.

We have books describing a considerable number of the flowering plants and even ferns growing in India and Ceylon, with drawings, coloured, hand and nature-printed of many of them, but we do not possess a good treatise on Indian grasses. Roxburgh and Dalzell and Gibson in their respective floras describe many Indian grasses, but there are several important omissions in them, as will be apparent from the list given below. Mr. Duthie's book, on fodder grasses of Northern India, is a valuable contribution to the study of grasses, but he confines himself to the fodder grasses of a part of India only.

Another difficulty in the way of the student of Botany on this side of India is the want of a good herbarium, as there is in Calcutta and in various parts of Europe, where plants are well mounted and named. The advantages of an herbarium are best known by those who have had occasion to resort to it. Mr. Duthie in his above mentioned book thus describes, in a few words, the benefit he derived from the Calcutta Herbarium :—"My annual visits to the Royal Botanical Gardens near Calcutta have been of much advantage, more particularly in connection with the strictly botanical portion of this work. In addition to an excellent library, there is the splendid herbarium, in which grasses from all parts of India are largely represented."*

In Europe, investigators receive assistance from many learned men, but here in India very few scientists have leisure enough to devote themselves to the study of grasses, and those who may have formed these the subject of their study, are prevented from giving to others the benefit of their knowledge by their being frequently moving from place to place in the districts.

---

* Since this was written, Mr. Woodrow, Lecturer in Botany and Agricultur at the Poona College of Science, has secured a large collection of flowering plants including grasses, from all parts of India.

I refer to these difficulties, not with the view to enhance the value of my labours, but because the very mention of them will, I am sure, incite ardent lovers of nature to enter upon the field of investigation better armed and better prepared. I may state here that those who wish to make new discoveries will find many opportunities, as the field is not yet exhausted; for, whilst this list was being drawn up, I received new grasses which had not come under my observation before, and from those very places from which specimens were formerly sent to me. It happens very often that peons or other persons sent to collect grasses, not being themselves trained, gather large or beautiful and elegant grasses, not heeding the smaller ones, which probably grow under their feet or alongside the bigger specimens.

Next to the scientific names of grasses in the "List," I have copied their Vernacular names as attached to the collections received from the various districts of the Presidency in order to satisfy the curiosity of the reader. It is generally thought that every grass should have a name. This is an error, for very few grasses are known by their proper Vernacular names. As in European countries, so also in India, the same plant has different names in different provinces, nay even four or five in the same province or village, and the same name is not unfrequently given to a variety of plants and great many names to the same plant, *e. g.*, the Vernacular name *Piven* is given to *Andropogon intermedius*, *A. odoratus*, *A. pertusus*, and *A. annulatus*, probably because they resemble one another, and have all their several spikes congested at the end of their culms. Vernacular names are sometimes invented to please the *Sáhib*, or to impress upon him the informer's knowledge; thus we have *Káli kussal*, *Pándhri kussal*, *Jangli kussal*, names given to grasses belonging to various tribes and genera without any affinity amongst them merely because the plants named are endowed with long awns. The fragrant roots of an *Andropogon* named *khas-khas* are known all over India, but the plant itself has different names in different provinces; of course, rice, náchni, bájri, jowári and kodra are well-known, but there are several varieties of other cultivated grain plants, such as *Panicum miliaceum* and *P. miliare*, some of which even botanists themselves find it often difficult to distinguish by their Vernacular names.

"Bamboos are well known to people who work and deal in

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them in different districts, but even here the names vary in each province.

"The names given are often fanciful to please the *Sáhib*, as stated above. If, after the lapse of some time, the man be asked, he will give you a different name from what he had done previously. The names of some of the grasses written in the duplicates received this year are not the same as those which were assigned to the same plant last year. For these reasons, I set very little value on them. For there is no certainty that these names, before being attached to each species, were verified by an intelligent person. The late Mr. H. C. Davidson, of the Revenue Survey Department, has collected grasses and herbs which grow in Alibág on the fields amongst the rice, bájri and other food-grain crops. After drying and mounting them properly and after due enquiry he attached to each specimen a paper inscribing in a few words the uses and the Vernacular names. It is only by such means that we can ascertain the true Vernacular names, and render them useful to those who are desirous to know, and thus indirectly promote the advancement of the science of Botany. It is thus that their value in tracing the history of the plant may be enhanced.

"As to the Sanskrit names, they are not more reliable than the Vernacular ones, being founded on less ascertained observation and description of the essential characters of the plants.

"In regard to the uses of the plants, I have made use of the short statements of Mr. Duthie made in his 'Fodder Grasses of N.-W. India,' and of Mr. Fergusson in his 'Catalogue of Ceylon Grasses,' especially when my information did not differ from these statements."

I have described all the grasses I received from Forest Officers and from some friends. I cannot say that I obtained materials for the present list from Sind; a few which are mentioned here, were kindly given me by the Lecturer in Botany of the Poona College of Science. This list is far from being complete. A complete list can only be prepared after many years, with several persons contributing to gather materials for the purpose or by employing collectors well trained, as is being at present done by the College of Science. Bombay has been explored for more than half a century by botanists, and yet, leaving aside grasses, a great number of flowering plants are discovered at the present day which have not been recorded in our best flora. The same may be said of England, the flora of which has been examined and re-examined by numerous highly competent botanists for more than a century, and yet till lately it had been receiving additions from year to year. However, even in its

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present state, my 'list' may be considered a useful contribution to the difficult study of the Bombay Agrostology, and will, I hope, be accepted as a guide by those who may wish to enter into the exploration of this field, which is not yet exhausted. Persons who have never considered the subject, are not aware of the difficulties one has to encounter in an undertaking of this kind. I had to work, as stated elsewhere, under great difficulties, but I went through it with great perseverance and cheerfulness, because the work I had undertaken was a labour of love. It now only remains for me to crave the indulgence of the reader for the irregularities, errors and want of uniformity, that of necessity must have crept into a work which has been written under failing health and after long interruptions, caused by my absence to Europe and to various parts of India for the benefit of my health.

J. C. LISBOA.

Bombay, February 1895.

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Dr. Lisboa breathed his last before the present work finally came out of the Press, and the following short obituary notice appeared in the "Journal of the Bombay Natural History Society" (issue of November 1897):—

OBITUARY.

Dr. J. C. Lisboa.

"A member of this Society and frequent contributor to these pages, passed over to the majority, at Poona, on 1st May 1897, aged 75. One of the early disciples at the Grant Medical College, Bombay, Dr. Lisboa had a long and successful career in Medicine, and having retired from practice occupied his well-earned leisure in botanical investigation. He made grasses a special subject of study, and, with the assistance and sympathy of his amiable and accomplished wife, acquired a truly remarkable knowledge of the structure and affinities of that very difficult group of plants. It is much regretted that his health began to break down soon after he had decided to publish a list of the Bombay Grasses, which is at present in the Press. In private life he was all that good men wish to be, and his loss is widely deplored."

INTRODUCTION.

The fact that the study of Bombay grasses though very interesting was very little pursued, led me to devote my attention to it. My work received support from Government. Shortly after its commencement, it was brought to the notice of Government by Mr. Bhimbhai Kirpárám, Acting Director of Land Records and Agriculture, who wrote :—

"With reference to paragraph 1 of Government Resolution No. 4880, dated 9th July 1886, Revenue Department, I have the honour to submit, in original, Dr. Lisboa's reply, from which it will be seen that almost all of the best fodder grasses mentioned in Mr. Duthie's work grow in the Bombay Presidency.

"2. Dr. Lisboa is a botanist of high reputation on this side of India, and has made the Bombay grasses a subject of his special study. He was good enough to write, at the request of Messrs. Nairne and Campbell, a paper for the Gazetteer on the uses of the plants of the Bombay Presidency. He also helped Mr. Campbell in many ways in connection with the botanical portions of the Gazetteer volumes. His interesting contribution has been published in Volume XXV of the Bombay Gazetteer (pages 1—307) and acknowledged by Government in their Resolution No. 3700, dated 19th October 1886, General Department.

"3. With a view to enable Dr. Lisboa to complete his investigations, I beg respectfully to suggest that the three Conservators of Forests and their Assistants be requested to send to Dr. Lisboa samples of grasses and to supply to him such information as he may require from time to time for the purpose of writing a paper on the grasses of the Bombay Presidency which, when ready, might, with advantage, be printed at the Government Central Press for the use of Government. I have consulted Dr. Lisboa, and he informs me that he will be glad to hand over to Government the manuscripts of his paper after reading it before one of the societies of Bombay."

On this recommendation, Government were pleased to pass the following Resolution :—

"The proposal made in paragraph 3 of the letter from the Director of Land Records and Agriculture is approved, and the three Conservators of Forests should be requested to forward to Dr. Lisboa samples of the various grasses growing in their respective Circles and to furnish him with any information he may require from time to time in connection therewith."

On the 22nd September 1894, Colonel Godfrey, Acting Survey Commissioner and Director of Land Records and Agriculture, wrote as follows to Government :—

"With reference to Government Resolution No. 521, dated 21st January 1890, Revenue Department, I have the honour to submit Dr. Lisboa's 'List of Bombay Grasses,' together with the forwarding letter and to

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suggest that 400 copies of the 'List' may be printed at the Government Central Press and distributed as per accompanying list, which provides for 50 copies required by Dr. Lisboa for private distribution.

"2. The 'List' was read before the meetings of the Bombay Natural History Society and has been published in the Society's Journals. Dr. Lisboa has made a special study of the Bombay Grasses, with special atten-ton to those of agricultural value, and deserves thanks from Government for this interesting paper."

On this letter Government framed the following Resolution:—

"His Excellency the Governor in Council is pleased to direct that Dr. Lisboa's 'List of Bombay Grasses' should be printed at the Government Central Press. As regards the style of printing and the type, the Superintendent of the Press should be requested to arrange with Dr. Lisboa, to whom should also be sent the proofs for correction and revision. Four hundred copies in all of the work should be struck off as suggested by the Survey Commissioner and Director of Land Records and Agriculture. Of these 50 should be forwarded to Dr. Lisboa, 25 to this Department, and the rest sent to the Survey Commissioner and Director of Land Records and Agriculture, for distribution in the manner indicated by him.

"2. The Survey Commissioner and Director of Land Records and Agriculture should be requested to convey to Dr. Lisboa the thanks of Government for the care and industry with which he has completed this important work."

Mr. Bhimbhai, if he happens to see this, will, I have no doubt, be gratified to learn that the book on Bombay fodder grasses, he strongly desired I should write, has received Government approbation. I am greatly indebted to him for having brought to the notice of Government my study of fodder grasses of the Bombay Presidency.

I have already elsewhere acknowledged with gratitude the assistance rendered me by the several Conservators of Forests and other Forest Officers, specially by Mr. Shuttleworth by supplying me twice grasses of the Central Circle; I desire to record in this place my best thanks to the following gentlemen: to Mr. Duthie, Superintendent of the Botanical Survey, Northern India, from whom I received many hints and valuable assistance at the beginning of my studies of grasses and who identified for me some grasses, and also generously gave me leave to copy some of his plates; to Mr. Thisleton Dyer, Superintendent of Royal Botanical Garden, Kew, and to Dr. Stapf for having identified for me some plants, the latter and Sir J. Hooker naming some of them after me; to Mr. J. M. Campbell, I.C.S., who, whilst Collector of the Panch Mahâls, aided me very materially by supplying me with different varieties of grasses and otherwise assisting me to complete my

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List, and to Mr. E. C. Ozanne, I.C.S., Survey Commissioner and Director, Land Records and Agriculture, from whom and from his Assistants Messrs. Ichhárám and Yashvantráo I received great encouragement in my work by their ready and hearty co-operation. It now only remains for me to express my thanks to Colonel Godfrey, Acting Survey Commissioner and Director, Land Records and Agriculture, for his so kindly taking the matter in hand, on Mr. Ozanne's departure on leave, and for forwarding my papers on grasses to Government. I would further acknowledge the care and interest shown by Mr. Frámroz, Superintendent, Government Central Press, Bombay, that this little book may be free as much as possible from the errors which the printers commit.

It may not be out of place to state here that we know very few facts regarding the grasses, the number of species which grow in this Presidency, and, I dare say, in other parts of India, their properties and uses, their habitat, the effects of soil, the modifications caused by cultivation, climate, and by their high and low situations. Certain kinds appear to prosper near shady places, and are found only near water-courses, others die in such places, and prefer dry sandy ground, or calcareous or clayey soil. Then again, some species are confined to particular localities, and there they undergo various modifications, some flourishing in the plains in warm and moist situations and growing luxuriantly; others become stunted or disappear altogether at higher elevations, whilst some species are to be only seen at very high and cool places. These cannot thrive on the plains below.

We see also some kinds of grasses growing in clumps in the society of other grasses or plants, and which are, therefore, named by some biologists "social plants," whilst others are spread over large areas, due probably to cultivation and other facilities for their propagation, for there are certain kinds which are found nearly always on cultivated ground.

Our information regarding the properties and uses is also very imperfect and meagre. Contradictory reports have reached me about the uses, some from one locality extolling the nutritive properties of a given grass, while others from a different locality are either silent about this fact, or tell us that the grass is not touched at all by cattle; the difference in some cases is probably due to one man having observed cattle grazing it when young, or during the prevalence of drought. It is a fact that all young green herbage is eaten at all times, and the old, which is not palatable, rejected or never touched.

There are some kinds which though good and palatable cannot be cut and stacked at all periods owing to the fact of their being

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brittle. Then again some grasses are said to be eaten by buffaloes only and injurious to crops of rice and bájri; and others to increase the secretion of milk.

We know very little of the commercial value of grasses in each district and táluka. Several scented grasses grow in the Presidency. An oil, called *Rosha* oil, of great commercial value, is extracted in large quantities in Khándesh from *Andropogon Schœnanthus*, Linn.; the roots of *Andropogon squarrosus*, Linn., *khas-khas*, are employed in making mats and fans and in the distillation of oil, which commands a high price, being used in the composition of many favourite perfumes, as "Monseline des Indes," "Marechal," "Bouquet du Roi"; *Andropogon citratus*, D. C., yields lemon grass and oil of verbena of commerce. The late Dr. W. Dymock distilled oil from *Andropogon odoratus*, Lisb., for experimental purposes. We know nothing of the uses the other scented grasses are put to.

The nutritive qualities of grasses are often judged in a general way from the situation of the species, or its outer appearance. But chemical analysis made at various stations and at different seasons can give us a good idea of the proportion of their nutrient constituents. Still chemistry cannot in all cases teach us if all the kinds of grasses which are readily tasted and grazed by cattle, or contain high proportions of nutrient principles, are also equally digestible. During the late famines in the Deccan, Southern Marátha Country and in Madras, people were seen to use the seeds of *Abutilon muticum*, *Indigofera linifolia*, *I. cordifolia*, *I. glandulosa*, *Alysicarpus nigosus*, &c. The analysis of these plants by Dr. Lyon, Government Chemical Analyser, has shown that all these seeds contain a large proportion of nitrogenous and carbonaceous principles—some quite as much as the best cultivated pulses. But the wild grains above mentioned were probably not easily digestible, for it was a common complaint that the people who had lived on them alone, had become emaciated and weak, and suffered from bowel disorders, due perhaps to the fact that large quantities had to be eaten to satisfy the wants of the system.

There were other plants used by famine-stricken people which contained less of nutritive principles and more of woody tissues, gummy and resinous substances and various extractive matters which are neither digestible nor nourishing; they may be palatable to the taste and temporarily appease the cravings of hunger, but their exclusive use for a lengthened period brings on decay and emaciation, and renders the constitution an easy prey to disease. This assertion is not based on theory alone. Numerous facts observed during the famines in Orissa, Behár, Madras and Southern Marátha Country prove that the protracted use of such herbs alone, even of *tackla*, *muchur*, &c., which are used in ordinary seasons in small quantities along with other food, was followed by emaciation and other symptoms of slow starvation, such as anemia, scurvy, &c., often proving fatal by inducing diarrhœa, dysentery, dropsy of the whole body, or abdomen alone. *Paspalum scrobiculatum* is extensively cultivated throughout India, and its grain *kodra* used as food by poorer classes of people; and unless proper precautions are taken, it proves sometimes poisonous, producing in men and cattle delirium, inability to walk, and other symptoms like those of *dhatura* poisoning. Chemical analysis and microscopical examination have not as yet revealed the poisonous principle.

Ensilage has its advantages of preserving grass by pressure, to be used during scarcity of rains. So also the experiments now made in the Cantonments to cultivate useful fodder. But the success of these experiments and of ensilage depends upon the selection of the grass; for what is said or supposed to be highly nutritious in one locality may lose some of its properties in other places. It is only by accurate observations carried on for a long time with the co-operation of several persons, that we can come to definite conclusions regarding the usefulness of the various kinds of grasses growing in Bombay and by the introduction of a given species in the plains—Deccan, Gujarát or Konkan—and of some exotics adapted to higher, moist or dry situations.

Government have ordered 400 copies of my "List" to be printed with the object, I should think, of their being distributed to all the public officers. It behoves all who are desirous of advancing the progress of the interesting science of Agrostology, to further the knowledge of agricultural plants of this country, keeping in mind several points I have briefly touched upon, to note down all facts which may come under their observation, and serve to add, to correct or supplement the contents of my little book and to forward the same to the Bombay Agricultural Department, sending at the same time well-mounted specimens of grasses. There they will be, I have no doubt, carefully kept and recorded. The accumulated facts thus communicated will form a nucleus for more extended observations and systematic enquiry, and be, in time, of use in publishing a second and more complete edition with illustrations of principal Bombay grasses.

I have appended to the description of each species a short account of its uses forwarded to me, but it must be admitted that fuller information is still wanting.

During the examination of the packets of grasses sent me, I had reasons to doubt the accuracy of some of the reports made by clerks and kárkúns, who, it appears, have put down on paper whatever was told them by collecting peons and sepoys, without due enquiry. But I must confess that fatigue prevented my keeping up a continuous correspondence; for, unaided I had to sort heaps of grasses received from various districts, tálukas and villages, mark down their numbers, habitat, copy the reports as to their uses, examine under microscope or lens for classification. I regret I did not ask for the assistance of a clerk as often suggested by friends.

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Fig 1.

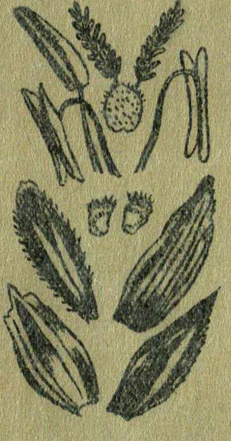
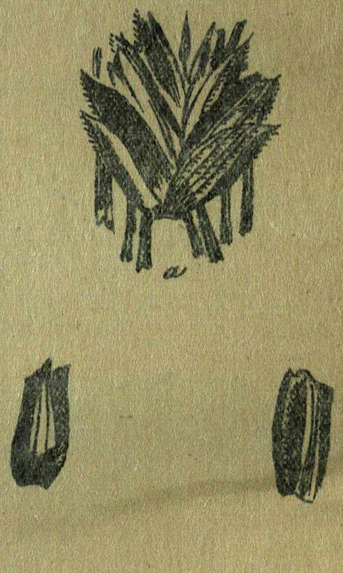


Fig 2.



The two outer glumes of a spikelet and the parts of a single floret of wheat.

The two lowest scales, right and left, are the outer glumes; of the next pair, the scale to the right is the flowering glume, that to the left the pale, then come the two minute lodicules, the three stamens, and the pistil.

No. 1. Triticum vulgare, Linn.

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BOMBAY GRASSES.

Gramineæ.—(The Grass Family.)

Herbs, shrubs, sometimes trees (bamboos). Stem, called *culm*, round, or sometimes compressed, solid or hollow between the nodes. Leaves(1) alternate, distichous, solitary, narrow, parallel-veined, entire, sheathing the stem at their base, but the sheath is split open from the base, and at its junction on the inner surface with the blade there is generally a small membranous, scarious, or hairy appendage called *Ligula*. The inflorescence is almost always terminal, and the *spikelets* (flowers) small, more or less green or scarious, arranged in panicles, racemes, or spikes. Each *spikelet* consists usually of several distichous scales called *glumes*, of which the 2 or sometimes 1 or 3 or more lower ones, and sometimes one or more upper ones are empty. Above the lower empty glumes there are what are called *flowering glumes*, each enclosing a small thin scale named *palea* marked with 2 longitudinal nerves or keels. Within the palea are 2 minute scales called *lodicules*(2) and usually 3 stamens, sometimes reduced to 2 or 1, or in some genera to 6 or more, with long filaments and versatile anthers. In the centre is a 1-celled ovary with 1 ovule. Styles 2 or 3, free, or united at the base, the stigmatic portion often feathery. Fruit 1-seeded, called a grain or *caryopsis*. Embryo small, on one side at the base of copious albumen. A bristle, often long, called awn, arises from 1 or more glumes. Grasses are found in all quarters of the globe, supplying food and raiment to man and fodder to cattle; and are applied to various economic purposes.

The reader must carefully examine the construction of the spikelet, which is different from that of flowers of other plants. The inflorescence of grasses, or the spikelets composing it, are arranged in racemes, panicles, spikes, or heads (often named indifferently *spikes*). Each spikelet consists, as already stated, of chaff-like bracts, called *glumes*, proceeding alternately from opposite sides of the spikelet. Some of the lower ones, and sometimes one or more upper ones, are empty and differently shaped. The glumes succeeding the lower empty ones are *flowering* glumes, each enclosing a smaller, generally thinner bract, marked by two keels or nerves and placed either between the glume and the axis of the spikelet with its back to its axis (called rachilla), or nearly opposite the glume at the end of the axis.

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(1) Used for lamina or blade.

(2) Seldom mentioned in the description of genera and species, because they are very minute, thin, difficult to see in the dried state and "are not," as Mr. Bentham observes, "known to form the basis of any practical determination of genera and species."

There is great variation in the arrangement of the glumes and flowers in spikelets. Some may be one or many flowered, or there may be spikelets with one perfect flower (hermaphrodite) or male or female only in the axil of a glume, or sometimes there may be a glume and palea without stamens and pistils. Some spikelets are in heads. The most curious arrangement is the one obtaining in the Job's tears grass, Hack. 42. In it the branchlets end into hard, pearly-white, globose, bead-like capsules enclosing the female flowers (one fertile and one or two sterile spikelets), and the male inflorescence projects beyond the orifice of the capsules and is composed of several spikelets in pairs. This grass and many others belonging to the Tribe MAYDEÆ are monœcious. All these varieties will be explained as we come to the description of each genus or species. I repeat that it is necessary to be well acquainted with the number, consistence, hardness or transparency, position, hairiness of the elements composing a spikelet, the minuteness (microscopic) of which constitutes one of the chief difficulties in distinguishing one species from another, but with patience and close observation they may be overcome.

There is another point demanding attention. It has been found that the rachilla, or the prolongation of the pedicel, is in some grasses articulated or jointed immediately below the lowest glume, so that when on drying a spikelet falls off, it breaks at the articulation. In other grasses the articulation of the rachilla is above the lowest empty glume, or between the flowering glumes, or there is no articulation at all. The knowledge of these facts has led the agrostologist to divide all the grasses into two great sections, the first group being named PANICACEÆ and the second POACEÆ. In PANICACEÆ the upper flower is hermaphrodite (or occasionally female by abortion), with sometimes a single male or sterile one below it. In POACEÆ the rachilla, as stated above, is jointed above the lower empty glumes, which remain persistent, and the pedicel is sometimes produced above the upper flowering glumes, bearing at times empty glumes, male flowers, or rudimentary ones.

Each of these primary groups or sections are divided into tribes and sub-tribes. Their most prominent characters are the following.*

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* In writing this *List* I have arranged the genera in accordance with the *Genera Plantarum* of Bentham and Hooker, the species being placed under each genus according to their affinities, as I understand them.

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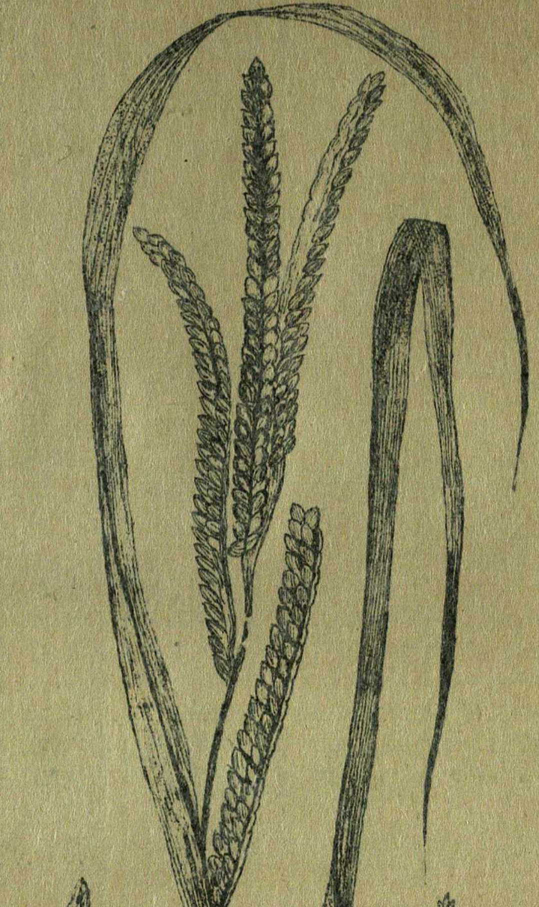


NO.2 *Paspalum scrobiculatum; Linn after Church.*

Series A.—PANICACEÆ.

Pedicels articulate below the glumes or cluster of glumes. Spikelet with one fertile flower, the male flower, if any, below it.

Tribe I.—PANICEÆ.

Spikelet with 1 terminal hermaphrodite flower or female flower. Empty glumes smaller, the outermost rarely wanting. Flowering glume not awned, coriaceous, hardened, or stiff at the time of fruiting. Awns when present are straight.

1. PASPALUM, Linn.

Spikelets, 1-flowered in 1 or 2 rows along one side of spikes, with a more or less flattened rachis. Glumes 3, not awned, 2 outer ones empty, the flowering glume slightly hardened; palea within the flowering glume.

There are 160 species ascribed to this genus; they grow in the tropics of both hemispheres, more abundantly represented in America. In this Presidency, about 5 have come under my observation, and Mr. Duthie mentions 4 as occurring in N.-W. India. P. EXILE with digitate spikes is said to be cultivated in Sierra Leone for the sake of its grain, which is used as food. P. DISTICHUM described by Roxburgh under the name of P. LONGIFLORUM, grows on the sea shores of India and Ceylon; its rhizome is used for the cure of inflammation of the gums and conjunctivitis, and in the Argentine Republic for liver complaint. The uses of P. SCROBICULATUM are described below.

1. P. SCROBICULATUM, Linn.; Kunth. Enum. I. 53.

Vern.—*Kodra.*

Culms 1—2 ft. high, usually glabrous. Leaves pilose at the base. Spikes 2—5 or more, 1—3 in. long; rachis flat. Spikelets sessile or on short pedicels in 2, sometimes in 3 or 4 rows, ovoid-orbicular, flat.

Habit.—Cultivated all over India in the hilly lands. Several varieties of this grass are mentioned by the natives. Two are well known, the *wholesome* and the *unwholesome*. The former is smaller and paler, and goes by the name of *pakodi* or *harrick*. The unwholesome is called *dhone* or *májare* in the Konkan and *mana kodra* in Gujarát. Although the 2 varieties have been styled respectively wholesome and unwholesome, the arrangement is only one of convenience, for all the varieties become under certain conditions of the atmosphere, &c., more or less poisonous, and the highly poisonous seed of one locality when sown in a soil different from that which produced it, may yield a grain whose properties may become either modified or intensified, according to the peculiarities of those localities.

The symptoms of poisoning resemble those caused by datura, and are severer in cattle than in man, due no doubt to their eating the grain and husk, and also to the absence of vomiting, an effect which almost always takes place in man.

2. PASPALUM COMPACTUM, Roth.

Cespitose. Stem bent and rooting at the lower 1 or 2 joints, then erect, from 5—15 in. or more, obsoletely quadrangular, glabrous. Leaves 1—2 in. striated with nerves on the upper surface, hairy at the margins, and with scanty hairs on the midrib on the lower surface. Ligula very small, consisting sometimes of stiff hairs. Sheath $1\frac{1}{2}$ in., hairy. Panicle on a long peduncle 3—6 in. long; branches 6—10 in number, the lowest $1\frac{1}{2}$ in. in length, decreasing upwards, the lower 2—4 solitary, the remaining opposite or alternate. Spikelets secund, solitary in one row, oval, slightly oblong, flat on one side, glabrous $\frac{3}{4}$ line ($1\frac{1}{2}$ m.m.); pedicel very small, nearly the length of the spikelet. First glume about $\frac{1}{2}$ line (1 m.m.), 3-nerved, the central nerve distinct; 2nd glume with 3 distinct nerves, size about $\frac{2}{3}$ line ($1\frac{1}{4}$ m.m.). Flowering glume as large as the 2nd glume. Palea nearly equal or a little shorter enclosed in the flowering glume, stiff.

Habit.—Not uncommon at Mahábaleshvar and Lanowli in the place known as Lanowli Woods and perhaps in the Konkan.

3. P. DISTICHUM, Linn.; Kunth. Enum. I. 52; P. LITTORALE, R. Br. Prod. 188; Trin. Sp. Grt. 112.

A small grass. Culm slender, creeping and rooting, often to great extent, the ascending part entirely covered with the leaf sheaths, 8 in. to 1 ft. or more. Sheaths with few hairs at the mouth. Ligula very small. Leaves very narrow, subulate, erect, involute or flat, $1\frac{1}{2}$ to $2\frac{1}{2}$ in. long, distant, with a few hairs at the base. Spikes 2 on the top of the peduncle, close together, divaricate, or one below at a distance of 1—2 lines, quite glabrous, 1 in. long. Spikelets sessile or very shortly pedicelled in 2 rows, oval, oblong, acute, flat, $1\frac{1}{2}$ to 2 lin. long. Outer empty glumes equal, distinctly 3-nerved, membranous. Flowering glume hardened and indistinctly 3-nerved, or only 1 central nerve.

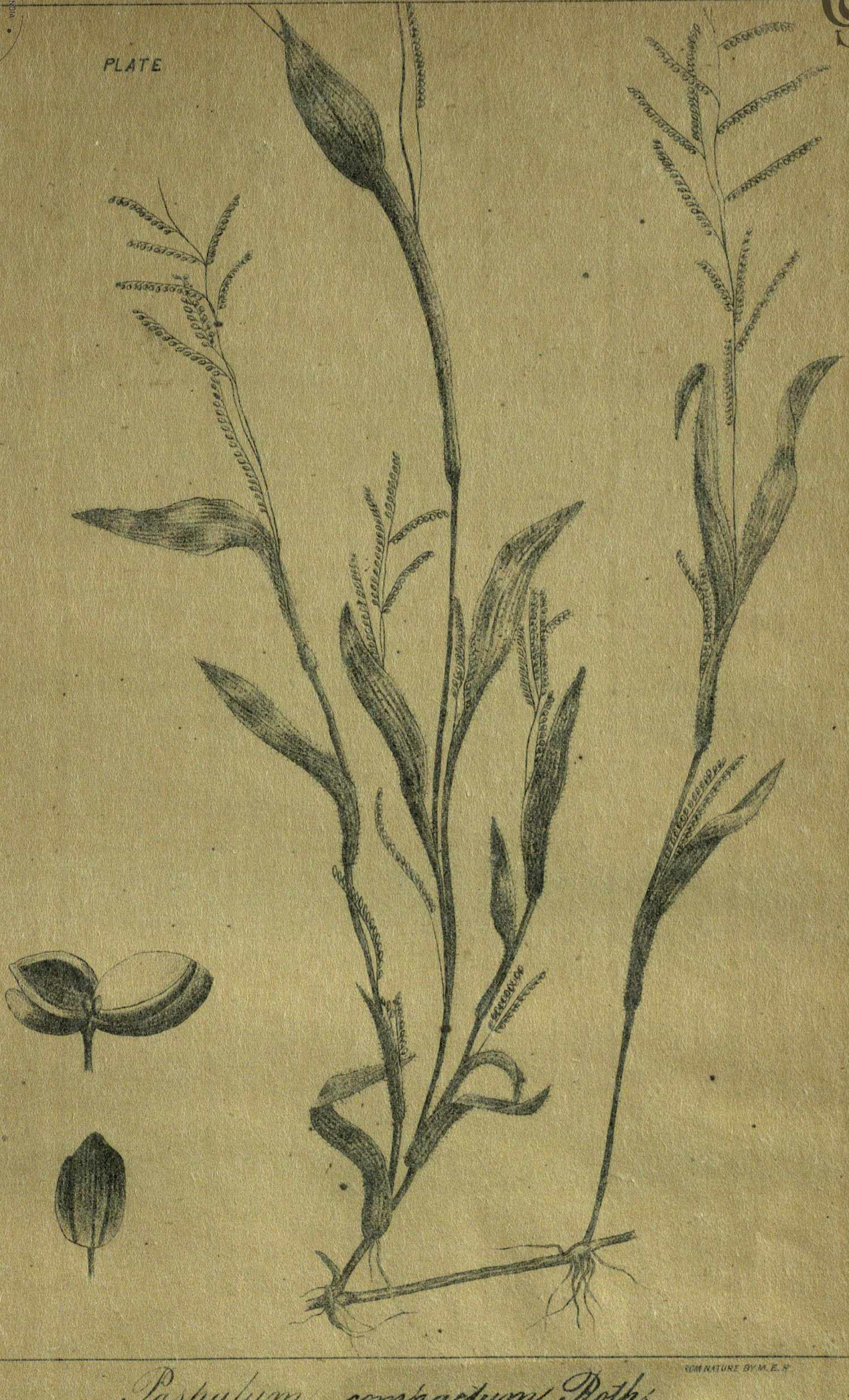
Habit.—All over the tropics. On the sea-shore, Bombay; found in Gujarát; collected by Mr. Woodrow at Shrivardhan, on the banks of rivulets, near the sea.

4. P. SANGUINALE, Lamk. See Panicum sanguinale.

5. P. PENNATUM, Hook. fl. Sind at Karáchi—Stocks.

6. P. TERNATUM, Hook, fl.; *Panicum ternatum*, Steud. Syn. Gram. 40.

PLATE



NO.3

ROM NATURE BY M. E. H.

Paspalum compactum, Roth.

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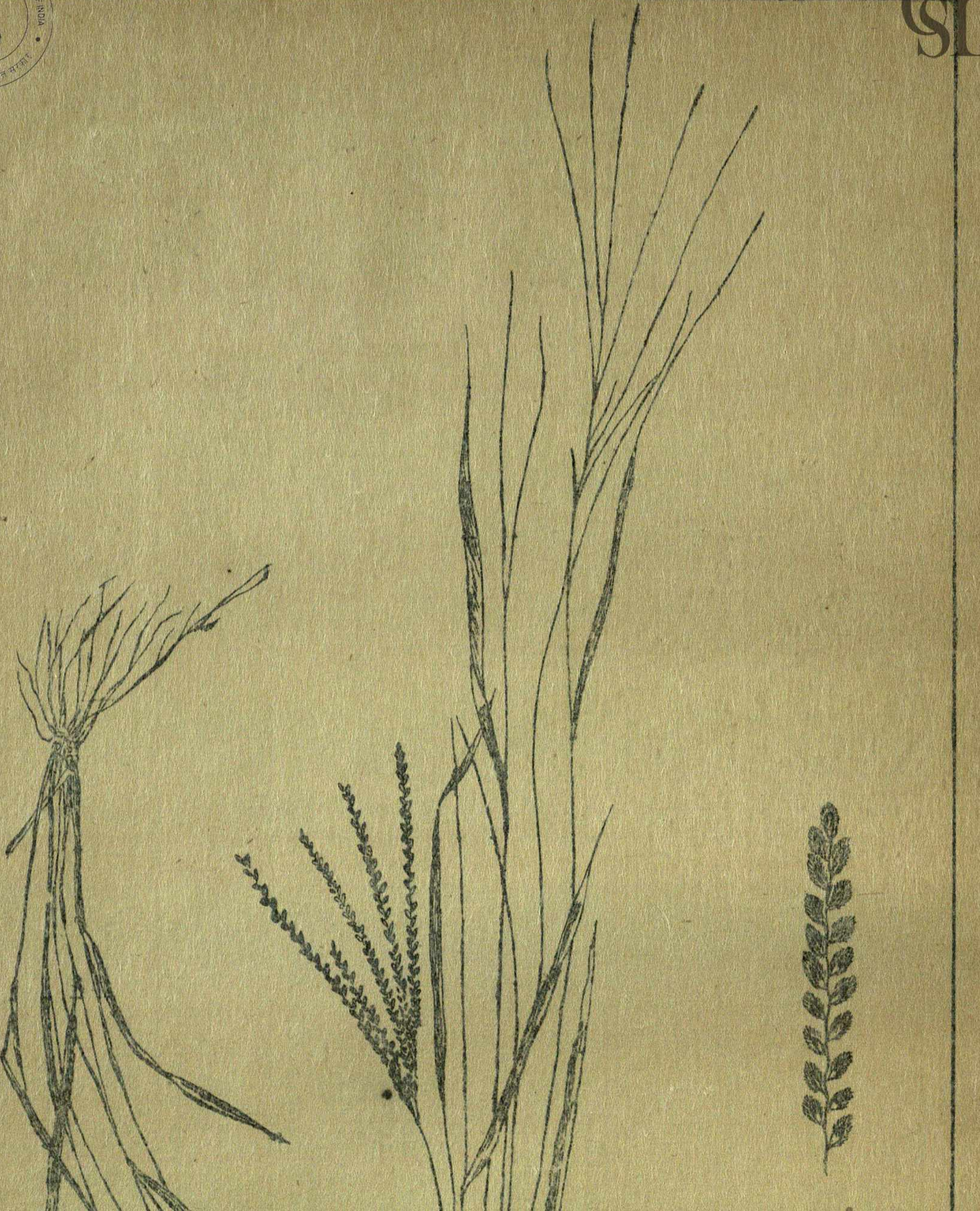

No. 4. *Paspalum minutiflorum, Steud.*

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Stem erect or decumbent below, spikes 2—3 subdigitate, rachis narrowly winged, ciliolate, spikelets minute geminate, imbricate, elliptic villous with clavellate hairs, pedicels setulose. 1st glume nearly equal to the 3rd; 2nd glume 5-nerved; 3rd ovate-oblong acute. I have not seen this grass. It has the habit of *P. ambiguum*, DC. Fl. Franc, which it so closely resembles that without microscopical examination it is very difficult to distinguish it from that species.

P. ternatum grows over the Western Ghâts, Bababudan, Belgaum, and Khasia Hills. The specimens of Bababudan are very short, those of Belgaum are tall and long-leaved.

7. P. LONGIFLORUM, Retz., in its dissimilar forms.

(*a*) P. MINUTIFLORUM, Steud. Syn. Glum. I. 17.

Rather tall, glabrous, resembling PANICUM PARVIFLORUM, R. Br., nearly allied to P. BREVIFOLIUM. Panicle branches rather numerous, filiform, alternate or clustered, 3—5 in. long. Spikelet very shortly but unequally pedicellate, ovate, acute, about ¾ lin. long. Empty glume prominently 3—5-nerved.

Habit.—Poona, Násik, very common in Thána.

(*b*) P. BREVIFOLIUM, Flügge; Kunth. Enum. 1. 48.

Culm slender, ½—1 ft. or more from a creeping rhizome, Nodes and sheaths pilose or pubescent. Ligula jagged. Spikes 2 or 3, digitate at the end of very slender peduncle, 1—2 in. long. Spikelet oblong, acute, about ¾ lin. long on very short pedicels, glabrous or finely hairy.

Habit.—Poona and Násik, not common; also in North-West of India and Australia.

Adopting Bentham's view (see Fl. Australiensis, Vol. 7) I have described *P. minutiflorum* and *P. breviflorum* as distinct species. But Hooker describes them in the Fl. of Br. Ind. as forms of P. longiflorum, Retz. Obs. IV. 15. This grass is very variable and has been described by agrostologists under various names. The extreme forms of this species are very dissimilar; the most marked are *P. longiflorum* proper (*breviflorum*, Fluegge) with often prostrate stems spreading from the root, or creeping and rooting from 6—12 in. with short lanceolate leaves, and 2—3 divaricate spikes and P. minutiflorum, Steud., with slender erect stems, narrow linear leaves and many long erect spikes exactly as *P. Royleanum*, Nees ex Thw. Enum. Pl. Zeyl. described by Nees in Herb. Wight, and *P. filiculme* in Herb. Strach and Winterb.; grows all over the hilly districts of India, Hymalaya and Ceylon.

I have collected and received specimens from various parts of this Presidency. This species has the habit of the tall forms of *P. longiflorum*. Specimens from Poona are tall, 2 feet high, very robust and branched from the base. They resemble very much those of P. minutiflorum from which they are to be distinguished, as Dr. Stafp has pointed out to Hooker, by the short clavellate hairs of the spikelets and the usually setulose pedicels.

8. P. ROYLEANUM, *Nees.* Hook. Fl. B. Ind. Vol. VII, page 18, and

9. P. PEDICELLARE, *Trin.* Hook. Fl. Br. Ind. Vol. VII. page 19, will probably be found within our boundaries.

2. ERIOCHLOA, H. B. K.

Like PASPALUM it has 3 glumes and inflorescence like that of PANICUM, but it differs from both by having a cup-like disc at the top of the pedicel, or rather on the calus of the lower glume. Spikelet 1-flowered. Flowering glume shorter than the outer empty glumes, but crowned with a point, or a short awn not exceeding the empty glume. Grain free from coriaceous flowering glume and palea.

The following is the only species :—

1. E. POLYSTACHYA, H. B. and K. Nov. Gen. and Sp. E. ANNULATA, Kunth. Enum. I. 75. PASPALUM ANNULATUM, Trin. Sp. Gram. t. 133. 2—3 ft. high. Sheaths pale, rather glaucous. Leaves dark green, with a few hairs at the base and on the nodes. Panicle-branches or spikes several, 1—1½ in. long. Spikelets narrow, acute or acuminate. Empty glumes usually 3—5-nerved, more or less hairy. Flowering glume coriaceous, shorter, but the midrib produced into a short awn as long as the outer glume as in the PANICUM HELOPUS.

Habit.—Not common. At Chaupáti and throughout India, Ceylon and Australia. In Australia it is used as fodder.

3. ISACHNE, R. Br.

Spikelet 2-flowered, 1 or both flowers hermaphrodite or the upper female or the lower male. Glumes unawned, 2 lower ones nearly equal and persistent below the joint of pedicel ; an exceptional character amongst the PANICEÆ. This genus is placed here, owing to the coriaceous consistence of the flowering glumes. Grain enclosed in, but free from the hardened glume and palea.

1. I. LISBOÆ, Hook. Fil. Sp. Nov.

Cespitose culm 4—7 in. or little more, straight, slender, branches from the lower part. Sheath ½—¾ in. lax with hairs, especially at the edges. Ligula small. Blade about 1 in., acute, striated with five lines, hairy specially at the margin. Branches of the panicle 5—6, almost horizontal, $\frac{3}{4}$—1 in. in length, secund; rachis and spikelet hairy. Spikelets broadly oval or almost round, 1 line long. Outer glumes empty, of a greenish brown colour containing 2 flowers, both fertile. The flowering glumes white, a little shorter than the empty ones. The palea is a little shorter than the flowering glume. Stigma not seen in the dried specimen. Style 2. Fruit small, convex on the outer surface and plane in the inner.

Habit.—This grass grows at Mahábaleshvar. Uses not known.

2. I. ALBENS, Trin. Sp. Gram. fig. 85.

Culm 2—3 ft. long, slender, decumbent, and rooting at the lower nodes, glabrous. Sheaths with few hairs. Ligula pilose. Leaves linear-lanceolate, glaucescent, margins white, 3—5 in. long. Spikelets pedicelled, very small on branches of a loose panicle.

Habit.—This elegant grass was received from Sholápur and North-West Provinces.

3. I. HIMALAICA, Hook. fl. Rajaori. Jacquemont. Is described in Hook. Fl. Br. Ind. Vol. VII. page 23.

"Erect, leaves linear or linear lanceolate strict, scaberulous above margins slightly thickened sheaths smooth, panicle pyramidal spikelets $\frac{1}{16}$ — $\frac{1}{14}$ in. globose, pedicels long capillary, tips hardly thickened; 1st and 2nd glumes unusually equal and both hemispheric."

4. I. ELEGANS, Dalz. and Gibs. Bomb. Fl. 291.

Vern.—*Doonda.*

Culm geniculate, about 8 in. long. Leaves 2—3 in. long, 3—4 lin. broad, deeply striated, and minutely serrulate on the margins. Spikelets pedicelled, globular, arranged in a panicle consisting of slender alternate branches. Glumes with red margins, tuberculated and hairy. Both flowers perfect.

Habit.—On the margins of rivulets in the Deccan (Dalz. and Gibs. B. Fl.)

5. I. AUSTRALIS, R. Br. Prod. 196.

Vern.—*Doaria* or *Dauria* (*Mez*, Mt. Abu).

Culm decumbent, rooting at the lower nodes; the ascending part 1 ft. or more. Leaves rough lanceolate. Spikelet pedicellate nearly 1 lin. long, glabrous on filiform branches of a loose panicle.

Lower flower usually male with a glabrous glume; the upper female, shortly pedicellate with its glumes minutely pubescent. Rachis with a swollen joint under the upper glume.

Habit.—Common in Poona, Násik, the Gháts and in Gujarát. Also in other parts of India, Ceylon and Australia. It grows in fields and destroys crops. Symonds says that horses and cattle eat it.

6. I. MILICEA, Roth. Pl. Sp. 58.

A small plant, the stem covered with sheaths, ciliate at the margins. Ligula narrow, hairy. Leaves linear-lanceolate, rough. Spikelet pedicelled, alternate, very small on filiform branches of a loose panicle. Glumes subequal, minutely pubescent. Lower flower male glabrous, the upper hermaphrodite, pubescent.

Habit.—Deccan and Lanowli.

7. I. DISPAR, *Trin.* Hook. Fl. of Br. Ind. Vol. VII. page 26, will probably be found within our boundaries.

4. **PANICUM**, Linn.

Spikelet either in a loose or spike-like panicle, or along one side of the simple branches of a panicle; usually small, 1-flowered, rarely awned. Glumes 4, the lowest small, sometimes reduced to a minute scale, not awned, 2nd empty, the 3rd empty or with a male flower or palea in its axil. The 4th or flowering glume of a firmer consistence, hard when in fruit. Palea rather smaller than the flowering glume and more or less 2-nerved.

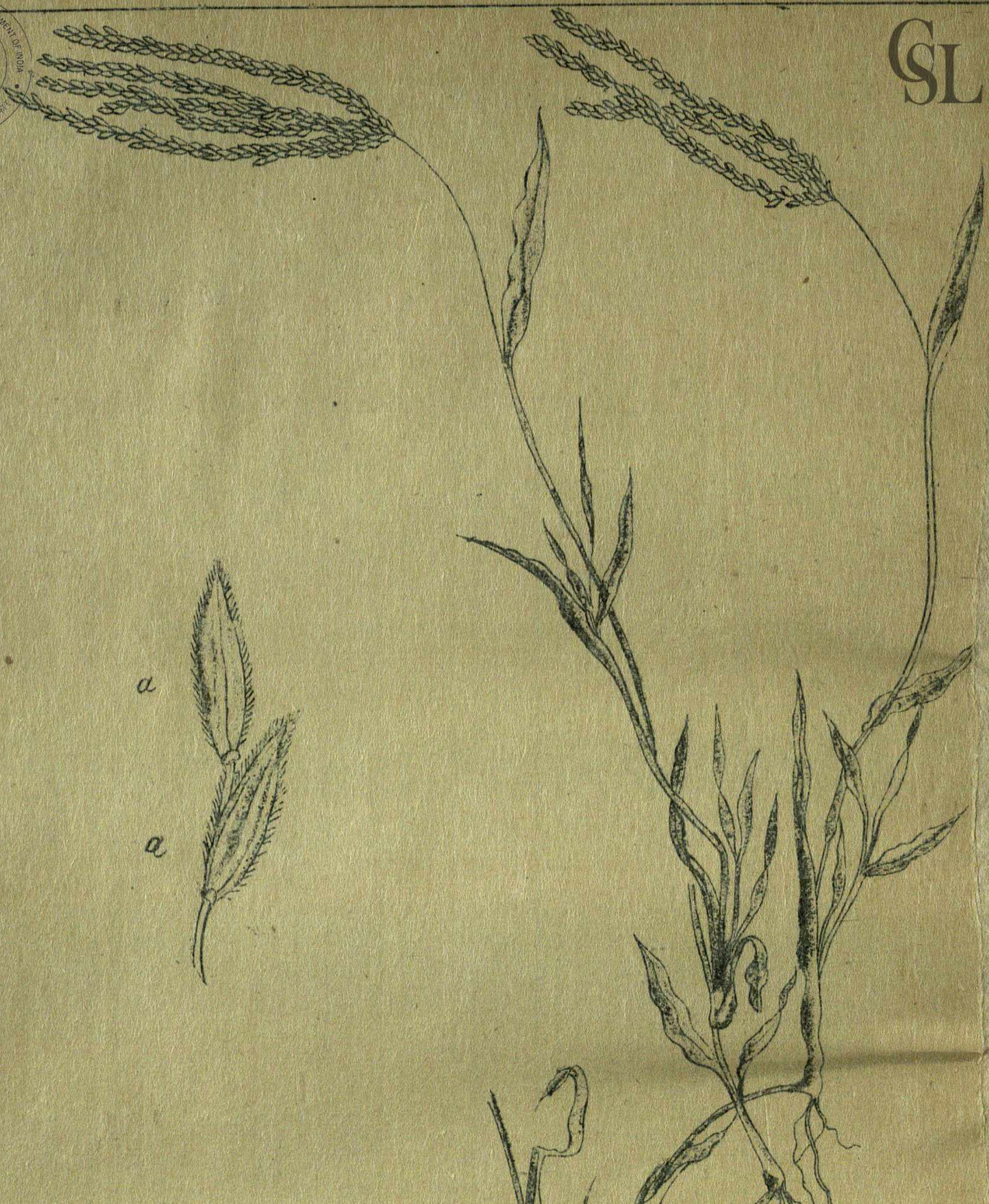
One of the largest genus of Gramineæ containing about 300 species; abundant in tropical countries and a few extending also into the temperate regions.

Several of these form excellent forage, owing to the abundant production of grain. On this account some species are cultivated in this and other countries.

The genus is divided into several sections; the following are more or less represented in this country :—

DIGITARIA.—Racemes or spikes simple, secund, digitate, clustered or rarely scattered. Spikelets in pairs, those of each pair unequally pedicelled. PANICUM SANGUINALE, Linn., belongs to this section, very common everywhere, but cultivated in Bohemia, where the fruit is used for *mush* and *porridge*. In S. United States, where it is known as *Crab grass*, it is valued as in some provinces of India as fodder. This section is removed to Paspalum by Hooker.

CSL



NO. 5. *Panicum sanguinale, Linn. Var. ciliare (after Trin.)*

PAGE 9'

BRACHIARIA or PASPALOIDEÆ.—Inflorescence as in PASPALUM. Spikelets shortly pedicellate, rarely 2-seriate, unawned; are distinguished by the number of glumes, the lower being small.

P. FLAVIDUM, P. FLUCTANS and P. HELOPUS belong to this section.

ECHINOCHLOA.—Spikelets in 3—4-rowed racemes, the second and third glumes terminating in more or less long awns, *e.g.* P. CRUS-GALLI, P. COLONUM and P. FRUMENTACEUM, Roxb. The latter cultivated in India for its seed. P. SPECTABILE is extensively grown as fodder in Brazil.

HYMENACHNE.—Spikelets small in cylindrical spike-like panicles, and the fruiting glume stiff, large, but not hard. P. MYOSUROIDES, P. INDICUS.

EUPANICUM.—Spikelets all pedicellate in more or less loose panicles. P. MILIACEUS cultivated from prehistoric times in India, China, Japan and in Egypt. Native country unknown, probably the East Indies. It is raised also to a considerable extent in India and Roumania. The following is the chemical composition given by Church :—In 100 parts there are, water 12·8, albuminoids 12·6, starch 69·4, oil 3·6, fibre 1·0, ash 1·4.

1. P. SANGUINALE, Linn.; Kunth. Enum. I. 82. Paspalum sanguinale, Hook. Fl. Br. Ind. Vol VII., page 13.

Vern.—*Fakri, Fakria.*

Culm decumbent, often rooting from the lower joints, then erect 1—2 ft. or more. Leaves distant, more or less hairy with long hairs, specially in the sheaths, sometimes glabrous. Panicle branches 2—6 (or 9) simple, slender, 3—5 in. long, arising from nearly the same point at the top of the peduncle, so as to appear to be digitate; hence this species is named by some botanists DIGITARIA SANGUINALIS. Rachis fluxuose, bordered. Spikelets in pairs, one almost sessile, the other pedicellate, oblong-acute, 1½ lin. long. The lower glume minute; 2nd 3-nerved; 3rd 5-nerved, fruiting glume shorter, smooth.

Var. P. CILIARE, Kunth. Enum. I. 82.

Vern.—*Kurad, Suka.*

Differs by having the inner glumes clothed with long hairs.

Habit.—Common everywhere in India and other warm countries. It is stated to be a good fodder grass highly valued in Rájputána and in the U. S. of America.

2. P. ISACHNE, *Roth.* P. ERUCIFORMÆ, Sibth. Fl. Greca. fig. 59.

GSL

Vern.—*Shimpi*, *Wag-hakt* (Bomb.); in other provinces *Seput*, *Sarpat*, *Ghuria*, *Tiliya*, *Chinwari*.

Culms much branched and bent below, pilose, 1—1½ ft. Nodes, sheaths and leaves hairy. Blades linear-lanceolate, 1—2 in. long. Spikes 6—8 erect, ½ in. long, appressed to a slender main hairy rachis. Spikelets biserial, secund, very hairy. Lower glume minute, sometimes wanting; 2nd and 3rd glumes equal, faintly 3-nerved.

Habit.—All over Bombay, but not common, also in other parts of India and Africa. Eaten by cattle; considered to be good fodder.

3. P. FLAVIDUM, Retz. Obs. IV. 15. P. BRISOIDES, Trin.

Culm branching from the base, 1—2 ft. or more. Sheath compressed, with a few hairs at the mouth. Leaves 3—6 in. long, glabrous. Panicle ½ ft. long, with several erect spikes appressed to the rachis. Spikelets sessile, ovoid, oblique, biserial on a flattened rachis. Outer glume short, broad and obtuse; 2nd the largest, the 3rd encloses in its axil a palea. Grain ovate.

Habit.—Common in Poona, Surat and throughout India. The grain, which is by no means scanty, is eaten by the poorer classes, especially in famine times. This species extends to Australia and there it is found that its panicles lie prostrate from the weight of the grain. Church found that the flour of the grain is indigestible. Its chief constituent is fat or oil. The grass is reckoned as good fodder for cattle.

4. P. PUNCTATUM, Pramb. Fl. Ind. 26; Retz. Obs. III. 8. P. Flustans, Dalz. and Gibs. Bomb. Fl. 290.

Vern.—*Pet-nar*, Bomb.; *Dossa*, Teling.

Culm glabrous, 2—3 ft. high, creeping and floating, rooting at the lower nodes, lower internodes very stout. Sheath bearded at the mouth. Leaves 4—8, smooth, ligula consists of a few hairs. Spikes many, distant, secund or alternate; tip free usually excurrent, setiform, size of the last spikelet. Spikelets very small. 1st glume very short, truncate; 2nd also truncate or rounded at the tip, equal to about half the 4th; 3rd acute 3—5-nerved, paleate, equal to the 4th; the flowering glume long acuminate. This closely resembles P. fluctans, but in the latter the rachis is not produced at the tip, the size of the 2nd glume.

Habit.—Grows in Poona near water-courses and all over India. Also in the tropics of both hemispheres; but not common.

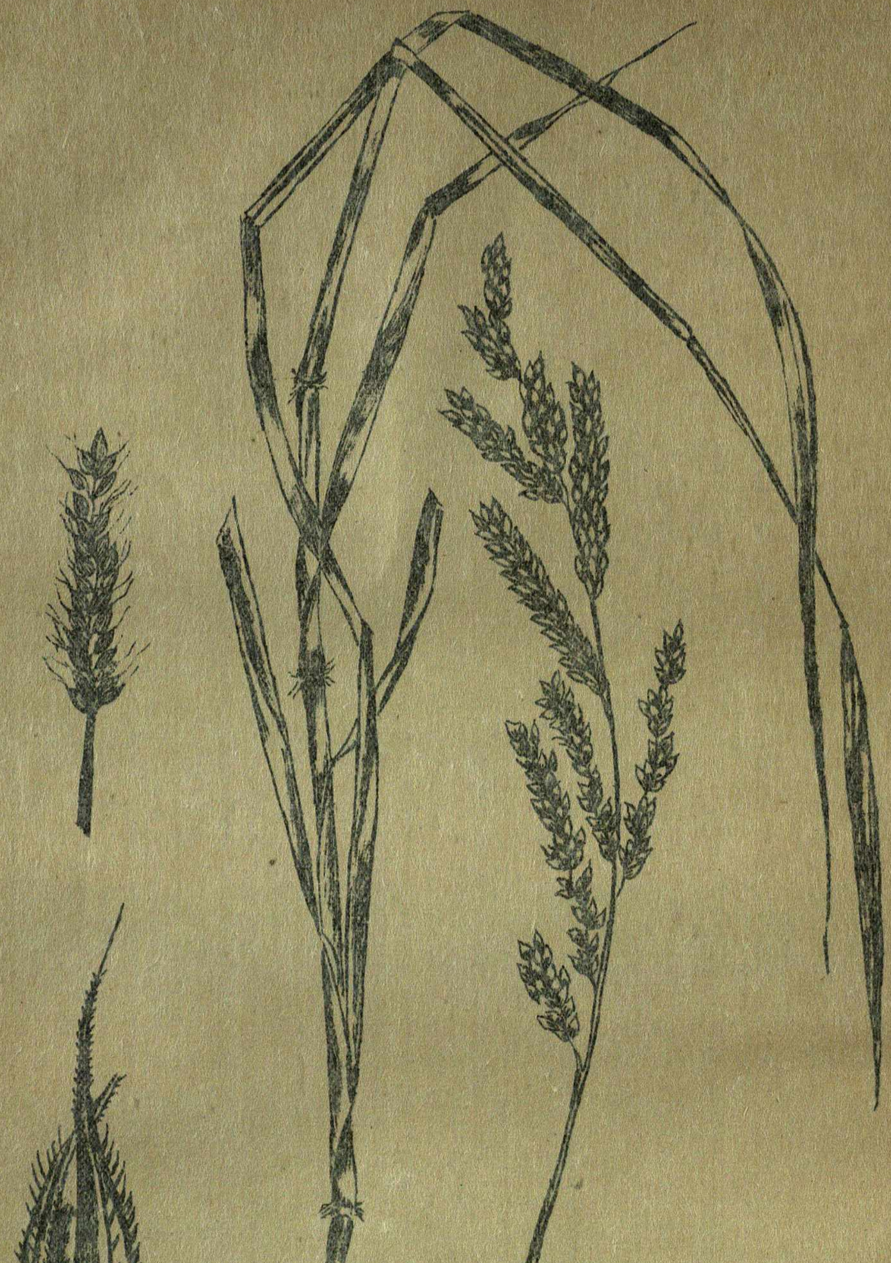
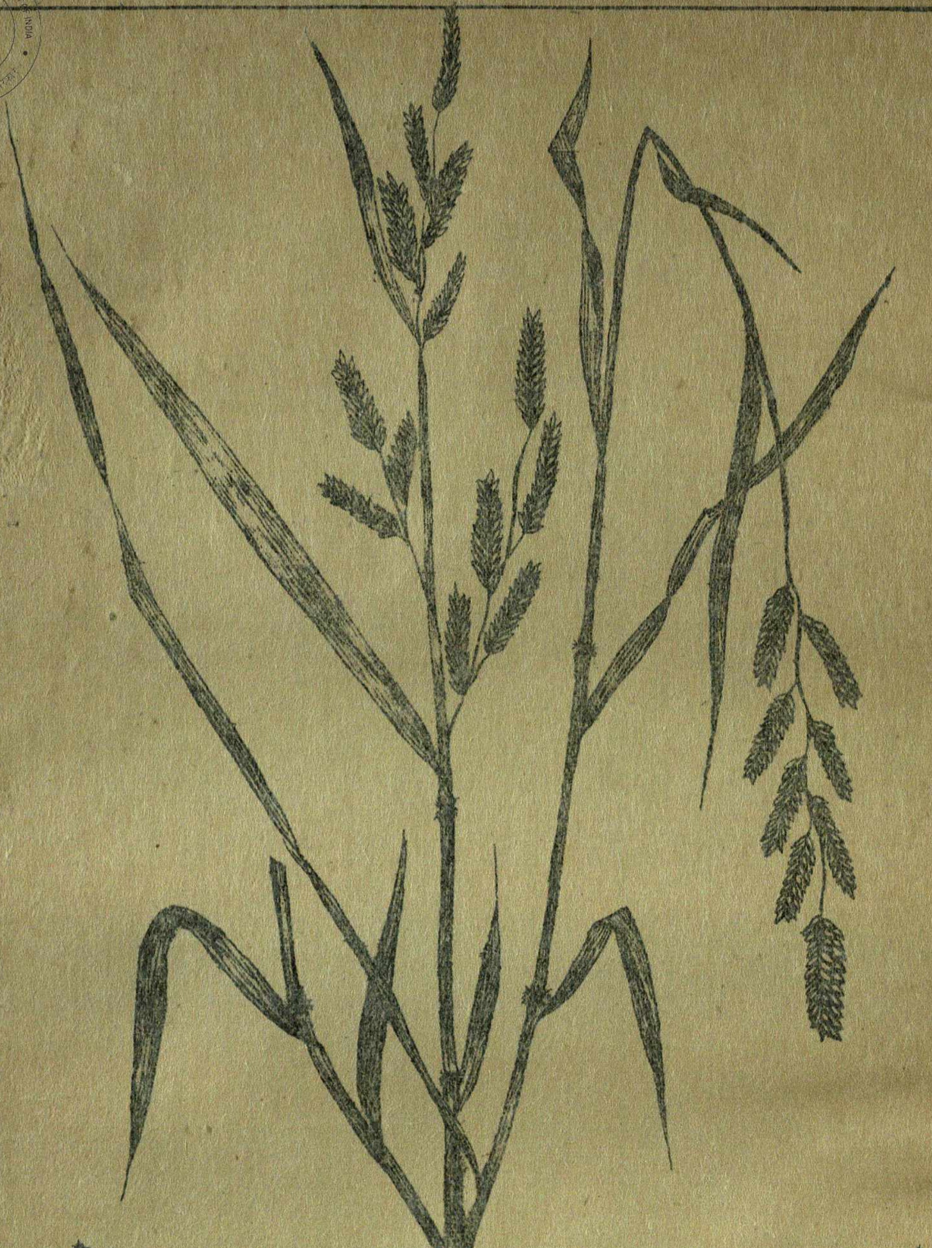


Fig. 1

Fig. 2

No. 6 *Panicum crus-galli, Linn*

CSL



No. 7

Panicum colonum, Linn.

PAGE 14.

CSL

5. P. CRUS-GALLI, Linn. Trin. Sp. Gram. t. 161, 162.

Vern.—*Bovar*, *Pacad*, *Sarvank*.

Culm creeping at the base then ascending to 1—3 ft. Leaves broad; no ligula. Panicles composed of alternate, secund short spikes, diminishing in length upwards. Spikelets usually in 2 rows more or less hispid hairy. The 2nd glume shortly awned; the 3rd with a long awn; a thin palea and rarely stamens in its axil. Fruiting glume not awned.

Habit.—Common weed in most hot and some temperate countries. It is similar to P. COLONUM, but coarse. The grain is not considered to be possessed of good nutritive qualities, and is mostly consumed by the poorer classes. It is sown in the N.-W. Provinces for its grain, and in Rájputána used as fodder. It thrives well in Australia. In America it is highly esteemed under the name of "Barn Yard Grass." In his "Report on the Agricultural Grasses of the United States" Dr. Vasey writes: "It is greedily eaten (at Mobile, U. S.) by horses and cattle and makes a hay of good quality. It is justly regarded as an excellent grass, particularly before it ripens its seeds. In Louisiana, Mississippi and other States, it is mowed annually and yields as much as four or five tons of hay per acre. Two cuttings are procurable each season when mowed as soon as it begins to bloom. It re-seeds the ground, and requires no care, save protection from live-stock. Cows and horses are very fond of it, green or dry."

6. P. COLONUM, Linn. Trin. Sp. Gram. t. 160.

Vern.—*Borur*, *Pakud* or *Pacushama*, *Sawank*, *Tor*, *Todia*, *Jiria*.

Culm a little compressed, erect or decumbent, rooting below. 2 ft. or more in height. Leaves glabrous, tapering from the base to a point. Spikes $\frac{1}{2}$—$\frac{3}{4}$ in. long, secund, 7—9, and not diminishing much upwards. Spikelets sessile in 4 rows. No bristles on rachis, except a few scales at the base. Glumes scabrous, unequal, 3-nerved, mucronate, not produced in an awn.

Habit.—Very common all over India, and in many parts of Australia, where its succulent culms are said to grow up to 8 ft. Thrives well in cultivated and rich soil. Much relished by cattle, and its nutritive qualities are enhanced by its grain which it yields in great abundance. The grain is said to be sold in the bazárs of the N.-W. Provinces, and much used by poor Hindus on their fast days, but the higher classes do not set any value on it, and eliminate it from rice with which it is often mixed by dealers.

7. P. FRUMENTACEUM, Roxb. I. 301.

Vern.—*Shamoola* (the grain), *Shama*, *Samuka*, *Sama*, *Sanwak*.

GSL

Erect, 2—4 ft. high. Leaves large. Panicle composed of numerous scattered spikes, sometimes forming verticels. Spikelets usually in threes, 1 sessile, the other 2 unequally pedicelled. Glumes 3—5-nerved, cuspidate. Lower glume very small. Flowering glume coriaceous, mucronate. There are several varieties of it.

Habit.—Commonly grown in and near the Ghát districts. Cattle are fond of it. Largely cultivated in N. India as a rainy season crop, but chiefly near and at low elevations on the hills. It is a rapid grower, coming to maturity within six weeks after sowing. The grain is not considered of a high class, and is mostly consumed by the poorer classes of people. The stalks are given as fodder to cattle.

8. P. PROSTRATUM, Linn. Trin. Sp. Gram. t. 184, 185.

Vern.—*Surpur Chaurela.*

Culm creeping and rooting at lower nodes and ascending to 1 ft. or more. Leaves (and sheaths) glabrous, or hispid with hairs bulbous at their bases 1—2 in. long or longer, lanceolate and acuminate with cordate base. Spikes 3—10, usually in pairs, forming a short ovate panicle. Spikelets usually in pairs with bristles on their pedicels. Outer glume very short, cordate, amplexicaul. The 3rd glume with a palea and sometimes anthers in its axil. Fruiting glume minutely wrinkled.

Habit.—Common in Poona, Gujarát, Surat and throughout India, Africa, W. Indies and Australia. Is considered a good fodder, and yields a considerable quantity of grain which is eaten by people in times of scarcity. Cattle are fond of it.

9. P. MUTICUM, *Forsk.* Trin. Sp. Gram. t. 318; P. SARMENTOSUM, Roxb. Fl. Ind. I. 309.

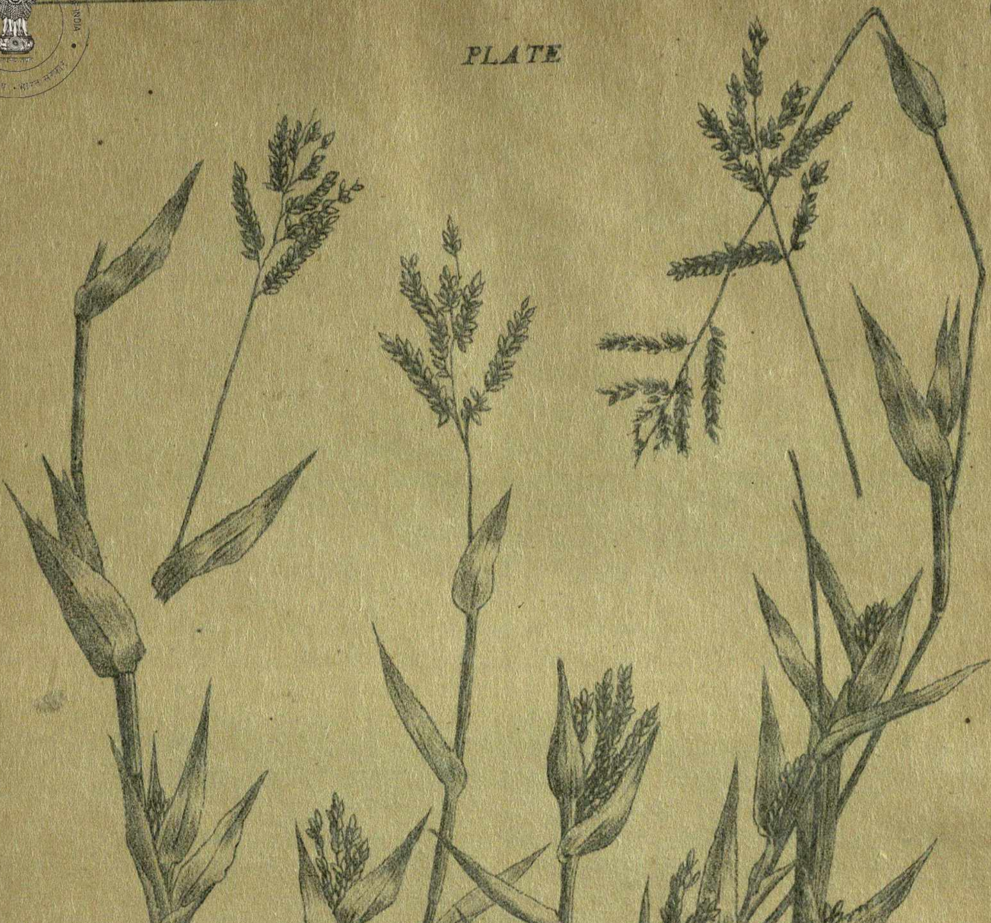
Perennial; stems attaining the height of 4—8 ft., pubescent. Nodes clothed with dense tuft of long white hairs. Sheaths loose, as long or longer than the nodes. Ligula hairy. Leaves linear, $\frac{1}{2}$—1 ft. long. Panicle ample 8—10 in. terminal with numerous diffuse branches. Spikelets sessile green or purplish; 1st glume $\frac{1}{4}$ of the spikelet; 2nd and 3rd nearly equal; 3rd paleate male numerous, crowded on the rachis, clothed with longitudinal hairs sometimes glabrous in time.

Habit.—A native of the W. Indies, naturalized in Mauritius, Seychelles, Ceylon, and now introduced in the Poona Government Farm. Trinius gives Brazil as its native place.

Mr. Fergusson states:—"I know that Roxburgh's description is the first given and that it originally came to the Botanical

CSL 12

PLATE



NC-8

Panicum prostratum. (after Trin)

PAGE 12

CSL

Gardens at Calcutta from Sumatra upwards of 70 years ago. Dr. Roxburgh's account of its introduction is as follows :—'A native of Sumatra and from thence introduced by Dr. Charles Campbell into the Botanic Gardens in 1804, where it grows luxuriantly and blossoms throughout the year'."

It appears that this grass was introduced from the West Indies into the Mauritius and from the latter place into Ceylon, where it is known as *Mauritius Grass.*

Mr. Fergusson says :—"This is the grass so well known, but very erroneously, as Mauritius Grass. It is not given in Bojer's *Hortus Mauritianus* dated 1837, and Moon does not give it a place in his Catalogue dated 1824. It has been a well-known fodder grass for several years past, grows in ravines and on the sides of streams in coffee estates, but in Colombo the cultivation and supply of this grass were nearly confined to the firm of Wilson, Ritchie, and Co., until their failure some years ago, when the natives, Tamil and Sinhalese, began to cultivate it extensively and now supply Colombo with this most useful grass. Unlike the *Guinea Grass* this one grows best in swampy or low grounds, but which must be well drained and manured to produce good crops. The owners of Mauritius Grass fields near Colombo send their carts into town and carry out a large portion of its scavenging refuse as manure for this grass, and a very considerable trade is carried on by the sale of this and 'Guinea Grass' in Colombo."

10. P. JAVANICUM, *Poir.* P. HELOPUS, Trin. Sp. Gram. fig. 183.

Vern.—*Kuri, Kuriya*; *Jal-ganti* (Bengal).

Culm creeping and rooting at the base. Sheaths hirsute. Leaves glabrous, or sometimes hirsute, broad-lanceolate, cordate at the base. Panicle branches 3—7, almost sessile above the upper leaf, or sometimes on a long peduncle. Spikelet irregularly biseriate and alternate, or the lower ones clustered, glabrous or hairy. Rachis usually with bristles. Outer glume very short, broad, 3-nerved; 2nd and 3rd nearly equal; the 3rd 5-nerved with a palea in the axil, but no flower. Fruiting glume minutely wrinkled; the central nerve produced into a short awn-like point.

Habit.—Grows in abundance chiefly in cultivated ground and extends even to about 5,000 ft. on the Himalaya. It is reckoned to be good fodder both for horses and cattle.

11. P. RAMOSUM, *Linn.* P. PETIVERII, Trin. Sp. Gram. t. 176.

Vern.—*Chapar, Chapsura.*

Decumbent annual, often rooting at the lower nodes, then ascending 1—2 ft. high. Leaves broad, rounded at the base acuminate, 2—3 in. long. Panicle branches 1—2 in., 1 or 2 together. Spikelets sessile or shortly pedicellate with bristles at the base, in pairs or solitary, loose, softly tomentose, almost equilateral. Lower glume ⅓ shorter than the spikelets.

Habit.—In Poona, plains of N. India; also in Africa. Rare. Good fodder.

12. P. SETIGERUM, Retz., is thus described in Flora B. India:

Leaves ovate lanceolate with long cilia towards the complexicaule base, margins below crenulately wrinkled, spikes alternate, pedicels with scattered long hairs, spikelets ⅛ in. biseriate alternate imbricate, subsessile ovate acuminate glabrous or pubescent; 1st glume ⅔ of the 3rd, obtuse 3-nerved; 2nd ovate lanceolate acuminate 7-nerved; 3rd, 5-nerved neuter, palea as broad acuminate; 4th broadly oblong, mucronate or shortly awned, finely rugolose.

13. P. DISTACHYUM, Linn.; Kunth. Enum. I. 91.

Vern.—*Motia.*

Culm slender, creeping and rooting at the lower nodes, then ascending to 1—2 ft. Leaves smooth, glabrous or scantily hairy at the mouth of the sheath. Panicle usually of 2—4, sometimes more distant, secund branches, 1—2 in. long, at first erect, afterwards spreading or reflexed. The rachis with a few scattered hairs. Spikelets loosely alternate or biseriate. Outer glume about ½ the length of the spikelet, broad with edges overlapping each other; 2nd and 3rd nearly equal, distinctly 3-nerved, a palea in the axil of the 3rd. Fruiting glume a little shorter, hardened with 3 distinct nerves.

Habit.—Found in Damaun, Poona and scattered all over India, the Malayan Archipelago and Australia. Said to be cultivated in the latter country for fodder, which it produces in large quantities.

14. P. MYURUS, Lamk.; P. INTERRUPTUM, Kunth. Enum. I. 86.

Vern.—*Pokalia.*

Erect 2—4 ft. high, glabrous, the lower part when under water rooting. Leaves long, about 1¼ ft.; base cordate; sheath smooth; ligula small. Panicle dense, cylindrical, sometimes interrupted at the base, branches closely appressed. Spikelets small. 1st glume usually inserted at a distance below the 2nd; this and the 3rd acuminate-subulate; flowering glume transparent, stiff, but not hardening round the grain.

Habit.—Not uncommon in Thána, Konkan, Ceylon in warm wet ground. It is not a good fodder grass. In Australia, however, it is considered to be nutritious to cattle.

15. P. AURITUM, *Presl.* Kunth. Enum. Pl. I. 113.

Culm 2—6 ft. erect rather compressed. Leaves linear-lanceolate 8—14 in. long, cordate at base sub-amplexicaul. Spike 8—12 in., branches alternate, contracted or more or less effuse. Pedicels shorter than or equal to spikelets. Spikelets solitary sessile or subsessile linear eliptic-lanceolate, acute glabrous. Lower glume half shorter than the spikelet 1—5-nerved, 2nd and 3rd sub-equal 5-nerved, 3rd with a small palea in the axil, no stamens, 4th glume acuminate mucronulate.

Habit.—In the marshes of the Konkan, Bengal, Burma, &c.

16. P. INTERRUPTUM, Willd. Sp. Pl. I. 341; Kunth. Enum. Pl. I. 87; Dalz. and Gibs. Bomb. Fl. 316.

Vern.—*Nardule, Wolan*, Bengali and Telegu names.

Culm stout, 3—5 ft. rooting at the lower joints. Leaves 6—12 by $\frac{1}{4}$—$\frac{1}{2}$ in. smooth, base rounded or subcordate. Sheath smooth, longer than the internodes; ligula membranous. Spike long, about 5—10 in. rachis terete, channelled. Spikelets subsessile, rather turgid, green; 1st glume hyaline, 5-nerved; 2nd glume ovate, obtuse 5—7-nerved. A small palea in the axil of the 3rd glume.

Very near P. mysuroides and the following species.

Habit.—"Clothing the margins of tanks throughout the Konkan; anthers purple long exerted," Dalz. and Gibs. Bomb. Fl. 311. Grows in deep standing water. Roxb.

17. P. INDICUM, Linn.; Kunth Enum. 133; Roxb. Fl. Ind. I. 285. P. AUGUSTUM, Trin. Sp. Gram. t. 334.

Culm slender, decumbent below, then ascending to 6 in. or a foot. Leaves linear, glabrous. Spike densely crowded with spikelets, cylindrical $\frac{1}{2}$—2 in. long, green or bluish purple, branches very short. Spikelets small, very shortly pedicelled, ovate lanceolate, acute, erect or decurved, glabrous or sparingly pubescent.

Very near P. mysuroides, R. Br., and P. interruptum, Willd.

Habit.—Konkan, Deccan and all over India.

18. P. MYOSUROIDES, R. Br.; P. ANGUSTUM, Trin. Sp. Gram. t. 334.

Vern.—*Kora-Lom, Pokalia, Didhina, Musa-panchi, Suphetkar.*

A small, slender, erect annual. Leaves narrow, spikelets green sometimes purplish crowded into dense cylindrical spikes. Outer glume small 3-nerved; 2nd glume very convex, and 3rd glume 5—7-nerved; 2nd and 3rd nearly equal; a minute palea in the axil of the latter.

GSL

Habit.—In Alibág and on low wet ground. Also in Australia. Eaten with relish by cattle.

19. P. TURGIDUM, Forsk. Fl. Æg. Arab.; Trin. Sp. Gram. Ic. t. 227; Duthie Fodder Grasses N. India.

Perennial. Root-stock woody, creeping, root fibres also thick, velvety. Stem thick, woody, 2—4 ft. high, clothed at the base with scarious leaf-sheaths, emitting proliferous fascicles of branches at the swollen sheathed nodes. Leaves 2—3 in. long, flat, coriaceous acuminate, reduced at the upper part to spathe-like sheaths. Panicle variable, 1—5 in. long, narrow with short erect branches. Spikelets shortly pedicelled, when young ovate-lanceolate, becoming by age tinged; 1st glume 5-nerved orbicular; 2nd glume broadly oval, acute, 7-nerved; 3rd glume longer than the second, acuminate, 9-nerved, paleate, male; 4th glume ovoid, short. Anther purple. Style 2 stigmas protruded at apex, primrose purple.

Habit.—Sind, Central India, extending to Arabia and Egypt, found at Baluchistán. My specimens are Kuchcha-mudra in Gujarát—"found growing at the edges of gardens."

It is stated by Duthie that a kind of bread is made from the grain in Egypt.

20. P. MILIACEUM, Linn.

Vern.—*Waree, Sáwa, Varagu, Worga, Chena, Chirwa, Bansi Phikar, Ráli.*

Stem 2—4 ft. high. Leaves large, hairy. Panicle much branched, ultimately nodding. Spikelets numerous, pedicellate, large. The lower glume 3-nerved, $\frac{1}{3}$rd shorter than the spikelets, acute; 2nd and 3rd, 5—7-nerved, with a palea in the axil of the 3rd. Grain oval with longitudinal lines.

Habit.—This grass is cultivated over the Gháts and different parts of India on account of its grain, which is considered nutritious by the natives and used by them as a kind of food at marriage ceremonies, and also during their religious fasts. The fodder obtainable from it is not of superior quality.

Several varieties of grain are sold in the Bombay bazárs, which it is difficult to trace to their source. The varieties are distinguished by the colour and size of the fruit, and the habit of the panicles. The plants themselves vary in appearance and stature. A grain, named *Badli*, referred to P. PILOSUM, by Dalz. and Gibs., is a variety of P. MILIACEUM. *Rale* or *Rali* is another small grain derived from a grass much less hairy than P. PILOSUM. The grain is said to be "very nutritious and is a favourite food in cases of exhaustion." Is also cultivated over the Gháts and Gujarát. *Danglee* is cultivated over the Gháts. It "has a lax cernuous panicle of awnless flowers."

21. P. MILIARE, Lam.; Roxb. I. 311.

Vern.—*Poi*, *Nilla-shama* (R), *Bagad*, *Badi*, *Kulti*, *Burburi*.

Stem 2—3 ft. Leaves narrow, acute, pointed. Panicle branches hispid, filiform, bending over with the weight of the grain. Spikelets in pairs; pedicels unequal. Lower glume smaller than the 2nd, 3-nerved. Fruiting glume coriaceous. Grain dark brown when ripe.

Habit.—It is cultivated in Gujarát and other parts of this Presidency, and is not uncommon on the Himálayas at moderate altitudes. The poorer classes of natives use the grain as an article of diet. Church gives the following analysis:—In 100 parts, water 10·2, albuminoids 9·1, starch 69·0, oil 3·6, fibre 4·6, ash 3·5. The straw is readily eaten by cattle.

22. P. PSILOPODIUM, Trin. Diss. II. 217.

This grass is named *Mordanura* in Khardi, Thána, where it is stated to be rare. It is probably a wild species of the last described PANICUM or P. MELIACEUM. Does not appear to be used at all in this Presidency, but Thwaites (Enum. p. 300) says it is cultivated by the Cinghalese under the same name *Mainairee* as P. MILIACEUM.

P. TRYPHERON, Schult.; P. ROXBURGHII, Spr.; P. TENELLUM, Roxb. Fl. Ind. I. 309.

Culm creeping and rooting at the lower nodes, then ascending to 1—2 ft. Leaves pilose, cordate at the base. Panicle usually as large as the rest of the plant. Branches capillary, decompound. Spikelets small, solitary. 2nd glume recurved and pointed. Fruiting glume, 5-nerved.

Habit.—Said to grow on cultivated ground. The above description is taken from Roxburgh. In my note-book, it is marked as "to be found at Malabár Hill, Bombay."

23. P. HUMILE, Nees; Steud. Syn. Gram. I. 84.

Vern.—*Kathi* and *Ardya*, Central Provinces.—Duthie.

Culm slender, 2—24 in., decumbent or erect, much branched. Sheath glabrous or sparsely hairy at the mouth, prominently nerved. Leaves lanceolate acuminate, or acute, 3—8 by $\frac{1}{2}$—$\frac{1}{6}$ in., glabrous.

CSL

Panicle 1—3 in. long, often as long as the whole plant, lax-flowered and diffusely branched; spikelets pale or reddish, minute, $\frac{1}{16}$ in., pedicellate ovate acute; 1st glume broadly ovate, acuminate prominently 3-nerved; 2nd glume longest, also 3-nerved, ovate-lanceolate, acuminate; 3rd glume a little shorter than the 2nd, ovate, acute, 3—5-nerved, paleate, neuter; 4th glume shorter, obtuse, curved outwards.

Habit.—Kondgul, N. Kánara, Baroda.

24. P. MAXIMUM, Jacq. t. 13; P. JUMENTORUM, Pers.; P. ALTISSIMUM, Dalz. and Gibs. Bomb. Fl. Suppl. 98.

Stem 3—8 ft. glabrous. Leaves linear, 1—2 ft. Panicle 1 ft. or more, loose, with numerous ascending branches. Spikelets pedicelled, glossy, glabrous. Lower glume $\frac{1}{4}$ the length of the spikelets, obtuse; 3rd glume with a male flower. Fruiting glume slightly rugose.

Habit.—This is the well-known *Guinea grass.* Though grown to a large extent in the West Indies, it does not, according to the authors of the "Bombay Flora," "fare well in India on account of the dry climate, unless grown in shady places and well irrigated." This was written in 1861. Since then, carefully conducted experiments have been made in various parts of India, as well as in Ceylon. I take the following from a letter written to me some time ago by Mr. Woodrow, Lecturer in Agriculture and Botany at the Poona College of Science. He says: "*Panicum jumentorum* is cultivated by so-called advanced cultivators throughout India. I have generally about 2 acres of it. At Madras I have seen 10 acres, and am told that near Ahmedabad there are about 100 acres. On a sandy soil with irrigation, it is found to be a profitable crop for forage to be cut green."

The following statement was furnished to me by the Director of Land Records and Agriculture*:—

"It has been grown on the Hyderabad Farm (Sind) since 1886-87, and has now almost passed the experimental stage. At present its cultivation is not very remunerative, but as time goes on, and the popular prejudice against its use wears out, it is hoped that it will, like lucerne, be one of the principal paying crops in the Farm.

"It is a perennial grass, and, when first planted, it frequently attains a height of 9 feet and sometimes even of 10 feet and above;

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* My best thanks are due to the Acting Director of Agriculture, Mr. Bhimbhai Kirpárám, for the ready assistance and valuable information which has been promptly placed at my disposal by this active and intelligent Government officer.

but when cut two or three times it does not grow so high but grows thicker, its tussacks varying from 6 inches to a foot in diameter. It penetrates deep into the soil, and on account of its long roots, it is more able to resist drought than many of the fodders cultivated. It is well suited for the edges of water channels, as the roots spread and protect the earth from being washed away.

"The following statement gives the results for the last three years:—

Area.	Year.	Outturn per Acre.	Value of Produce per Acre.	Cost of cultivation per Acre.	Remarks.
A. g.		Lbs.	Rs.	Rs.	
0·20	1886-87	16,748	128	159	Soil, stiff clay, hard to work. Sown on 13th March. Top dressed (1) 18th August 1 ton of poudrette; (2) 8th September 1 ton of poudrette; (3) 9 cwts. goat manure. Once weeded and 21 times watered.
Do.	1887-88	16,498	116	77	Last year's crop; twice top dressed; 18th May 2¾ tons of cow manure; 25 August 4½ tons cow-dung; twice ploughed between rows; 45 times watered.
Do.	1888-89	10,136	67	54	Third year's crop once weeded and 19 times watered.
2·13	1887-88	13,071	101	143	Mostly light sandy soil. Sown in April. Manured with 10½ tons of cow-dung and 1¼ tons of goat manure per acre. Once top dressed with 8 tons of cow manure and 2½ tons of goat manure per acre. 4 times weeded and 15 times watered.
Do.	1888-89	12,602	86	105	Second year's crop. Twice weeded and once ploughed. Once top dressed with 10 tons 76 lbs. of cow manure; 19 times watered.

"In the first year it does not pay, and this is mainly due to the first cost of preparing and planting the field."

As the subject of the cultivation of this exotic grass is one of considerable interest, I have embodied in this paper the results of experiments made elsewhere in the hope of their proving of some benefit to the cultivator and others.

Mr. Simmons in his brochure on *Indian Grasses* gives the following history of the experiments made in Saidápet (Madras):—

"*Guinea Grass*—has, of all the grasses experimented with, been found to be the best; it is an exotic, but perfectly acclimatized

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grass, which is most easily propagated by root-cuttings. Its culture is very simple, for if planted at the commencement of the rains, it soon strikes root, and is then safe and out of danger for the future. If planted in rows, it allows of interculture by cattle power, by which means the land on which it grows may be easily cleansed; thus it affords an excellent crop for a rotation. It has been found capable of withstanding our longest and severest droughts without the aid of irrigation, and although its energies remain dormant during such a time, the first rain makes it spring up again most rapidly. This power was never more clear than in a field planted in September 1875, measuring about two acres, which, in May 1877, after the great drought, was as brown and as dry as if it were totally devoid of life; the heavy rains which fell during that month, however, led to its immediate revival, and before the third day of rain was over, green shoots had appeared all over the field which grew on and produced a good crop of fodder in two months, which weighed green 5,556 lbs.; this was followed by another cutting of 4,564 lbs. of dry fodder; two months after, an amount equal to about 12,000 lbs., green. Not one per cent. of the tufts failed to throw out shoots after the rain referred to.

"An idea still prevails that Guinea grass must be irrigated not only at the time planted, but regularly at stated intervals afterwards; that it must be taken up and be replanted on new ground at the end of every two years at the furthest; and that the fodder is not a suitable food for stock, and can only be used in small quantities for such a purpose. It is perfectly true that if Guinea grass is planted in the hot season, or during dry weather, when the soil contains scarcely a particle of moisture, and the sky is clear and bright, that the plants will fail completely if not planted under such circumstances. In the dryest parts of the country, there is always a time when the sky is cloudy and the weather showery; and if such opportunities are properly utilized for planting, the roots can be established well without the aid of irrigation. Irrigation, of course, enables more cuttings to be obtained in the year, but it is never necessary for the maintenance of the crop. It is, however, most necessary to manure land well for Guinea grass. It is general on the farm to plant this grass (the sets being obtained by dividing into several parts old tussack from another field) on the ridge on a showery day, care being taken that they are planted uniformly at a distance of 2 feet apart in each direction, thus admitting the use of the plough between the lines of plants and across these lines at right angles; for it is advisable to pass a plough or cultivator occasionally through and across the crop, as the absorbtive powers of the soil can, in this

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way, be kept up. This ploughing or cultivating should be repeated at any rate once after the removal of each cutting.

"Before the end of the second year the plants from frequent cutting will have formed large tussacks; these would be reduced by simple chopping with a spade, hoe, or man-vitti. It has been found best to make two cuts across the tussacks at right angles to each other, thus dividing it into four parts. Of these, three may be removed and form excellent bedding for cattle stalls, the fourth remaining to perpetuate the crop. In this way there is no necessity to remove the plants to other ground, but care must be exercised to see that the soil is properly manured, as a crop which yields such large returns necessarily makes large demands on the soil. The fodder can be used for all kinds of stock: at first it seems to disturb the digestive organs of some animals, but this is only temporary; cattle and sheep have been fed on it exclusively for months not only without any ill effects, but with the most satisfactory results. A Guinea grass field is a capital place in which to graze working cattle during the hot season, while for ewes with young lambs better pasture could scarcely be discovered. It produces an abundant flow of milk in the ewes, without, what is common in such cases, disturbing the health of either mother or lambs; care must, however, be always observed never to graze Guinea grass too closely."

Equally successful experiments have been made in Ceylon. Mr. Fergusson says in his Catalogue of Ceylon Grasses the following:—

"It is the *Rata* (foreign) *Tana* of the Singhalese. When and by whom it was introduced to Ceylon I find no record, though it is probable there may be one in the Royal Gardens at Peradeniya. It was grown in Ceylon in Moon's time, 1824 at any rate. The late Dr. Gardener introduced what he supposed to be a new fodder grass to Ceylon, but in 1843 or 1844, he gave a full description of it in the *Ceylon Observer*, proving that it was identical with Guinea grass. It was introduced to Jamaica about 1744 from the Coast of Guinea. The following is an extract from Lunan's Hortus Jamaicensis:—

"'This most valuable grass is a native of Africa, and was introduced into the island many years ago by the merest accident. Mr. John Ellis got some birds from the Coast of Guinea, and with them some seeds for their support; the birds dying soon after, the seeds were thrown out of doors as useless. From these seeds grew some luxuriant grass, which attracted Mr. Ellis's notice, and he had a horse and a cow brought where it was, when both of them greedily ate of it. It was then transplanted into a garden and gradually cultivated, until it has become one of the most lucrative and useful plants in Jamaica. It agrees with almost every soil and situation, and has rendered many rocky and otherwise barren spots of Jamaica very valuable as affording support to herds of cattle and horses. The growth of this grass is quick, for in wet weather, and in a favourable situation, it may be cut once in a fortnight. It resists dry weather for a considerable time, and even when parched up, the slightest shower will revive it. It is from five to eight feet high. When of proper strength it raises very excellent food for horses and cattle, which, when considerably lean and reduced, will be restored to flesh and fatness in two or three months by feeding upon it.'

"There can be no doubt that the Guinea grass, and what is most erroneously called in Ceylon *Mauritius grass*, are the two most valuable fodder plants growing in Ceylon. I have seen the Guinea grass grow in what seems to be the pure white sand of the Cinnamon Gardens near Colombo to a height of 6 to 8 feet, and if well manured and kept free of weeds, it will, in rainy weather, give a very fair crop monthly. It grows freely up to an elevation of 5,000 to 6,000 feet on the Coffee Estates, but though a valuable fodder grass at these elevations, it does not grow to such a height as it does at lower elevations. It is extensively planted along the edges of foot and bridle-paths on Coffee Estates; but Mr. Morris gave his opinion against this practice, as the grass is supposed to harbour the mycelium of the Coffee leaf fungus."

Duthie, at p. 9 of the "Fodder Grasses of Northern India," states that "this is the 'Guinea Grass,' a native of Tropical Africa, and now extensively cultivated in most tropical countries. Although it seeds freely in this country, it is nevertheless found preferable to propagate it by root cuttings. In the *United States* it is usually planted in this way, as it rarely matures seed in that country. Manuring is beneficial where frosts prevail. Analysis shows it to be very rich in nutritive qualities, and as it appears to thrive well in the plains of Northern India, its extended cultivation should be encouraged."

25. P. REPENS. Linn. Kunth. Enum. I. 103.

Vern.—*Berad.*

Creeping and rooting at the base, ascending to 1—2 ft. Leaves more or less hairy at the cordate base. Ligula ciliate. Panicle branches 4—10 spikes on flexuose rachis. Outer glume less than ½ the length of the spikelet, rotundate. 2nd and 3rd 3—5-nerved, the latter with a male flower.

Habit.—It grows all over Bombay and N. India, and extends to Ceylon and Australia. It also occurs in N. Africa, S. Europe

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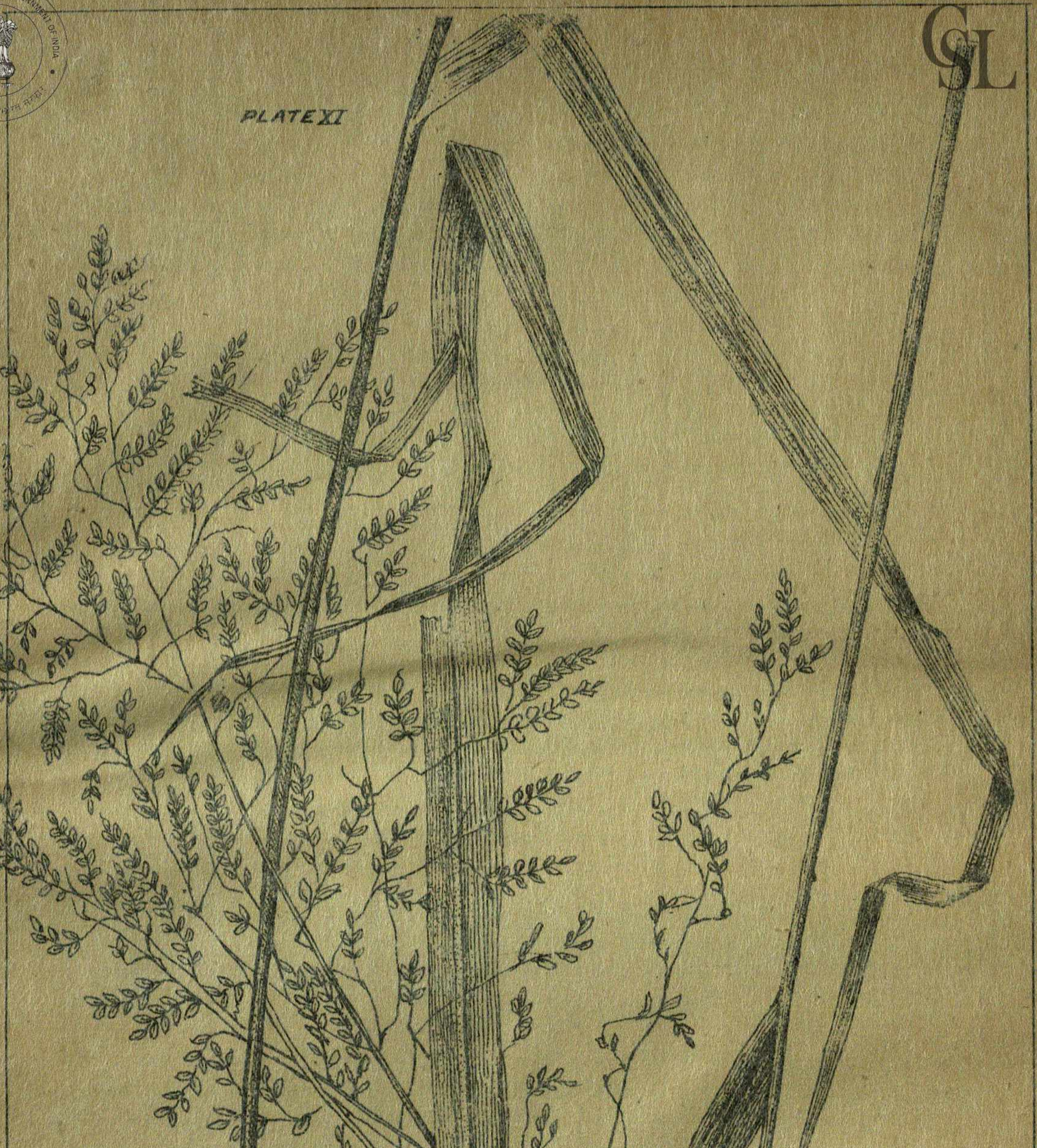
PLATE XI



NO.9

Panicum Antidotale, Retz.

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and on the coast of Brazil. Both horses and cattle relish it. Roxburgh states that cattle are fond of it. Mr. Fergusson in his "Grasses of Ceylon" says :—"It is indigenous to Europe, Africa, Asia and America, and in Ceylon grows equally well in the dry sandy soil, as it does in marshes or water, its long creeping underground stems enabling it to endure the hot dry weather. It is one of the most difficult plants to get rid of, once it establishes itself in any locality, and in this respect resembles the *Triticum repens* of Europe. It is found from the sea coast up to Newera Eliya, and is a common weed on some coffee estates."

26. P. PROLIFERUM, Lam.; P. DECOMPOSITUM, R. Br. Prod. 191.

Vern.—*Boruti, Kulus-nan.*

Tall glabrous, sometimes growing in water. Leaves long and rather broad when growing in water, glabrous. Ligula ciliate. Panicle with long branches capillary, decompound. Spikelets pedicelled, usually of a pale colour. Lower glume truncate; 2nd and 3rd membranous, 5—9-nerved. Fruiting glume smooth.

Habit.—Not uncommon in Poona, Lanowli and Sálsette.

27. P. ANTIDOTALE, Retz. Kunth. Enum. I. 125.

Vern.—*Git, Sera, Male, Shamukha, Gharam, Ghamar, Girni, Mangrur, Barn, Barwari, Barigagli.*

Glabrous, 2—3 ft. Nodes tumid. Ligula jagged or ciliate. Panicle usually 3—4 in. long, sometimes 8—12 in. with spreading branches. Spikelets in clusters or short spikes. Outer glume less than ½ the length of the spikelet; 2nd and 3rd nearly equal; a male flower in the axil of the latter: fruiting glume coriaceous. The inflorescence resembles that of "Guinea grass." Is a coarse grass, not generally considered to be a good fodder, but used when superior kinds fail. Mr. Coldstream reporting from Hissar states that it is grazed only when green, as it afterwards becomes bitter or saltish, and poisonous to cattle. Its smoke has the reputation of a disinfectant in small-pox and in healing wounds. In Madras it is used in throat affections. It extends to N. Australia.

28. P. MONTANUM, Roxb. I. 313.

Vern.—*Salket.*

Erect, rigid, 3—4 ft. high or more, glabrous. Mouth of sheath and the contiguous margins of the leaves ciliate. Leaves striated, base unequally divided by the middle-nerve. Branches of the panicle 12—18 in., filiform, straight, loose. Spikelets small, distant; 1st glume ovate, 5-nerved, no palea in the axil of the 3rd glume.

Habit.—Tháua, at a place named Khardi. Dispersed all over India and as far as South China.

The leaves of ANDROPOGON HUGELII are likewise unequally divided by the middle rib.

29. P. PLICATUM, Lamk.; Trin. Sp. Gram. I. 223.

Erect, 3—8 ft. high. Sheath bearded at the mouth. Leaves plicate, ½—1 ft. long, 1—1½ in. broad at the middle, more or less hairy. Panicle branches short, often long, filiform, and ending in a stiff bristle. Spikelets solitary, or 2 or 3 together, pedicelled, with a long bristle often springing from the pedicel. 1st glume 5-nerved, 2nd 5—7-nerved, 3rd glume usually with a male flower.

Habit.—Parel and western side of the Gháts, Nepal and in Ceylon up to 2,000 ft.

30. P. PATENS, Linn.; P. RADICANS, Retz.; P. ACCRESCENS, Trin. Sp. Gram. t. 88.

Rooting at the base, decumbent, then ascending to 1 ft. Sheath pilose at the margins. Ligula short. Leaves lanceolate, hispid from hairs; bulbous at the roots. Panicle branches numerous, capillary; solitary or 2 together. Spikelet very small. Glumes 3-nerved. Flowering glume coriaceous, mucronate.

The description is taken from a specimen in the collection in the Poona College of Science.

Habit.—Not given. Said to grow in India and the Philippine Islands.

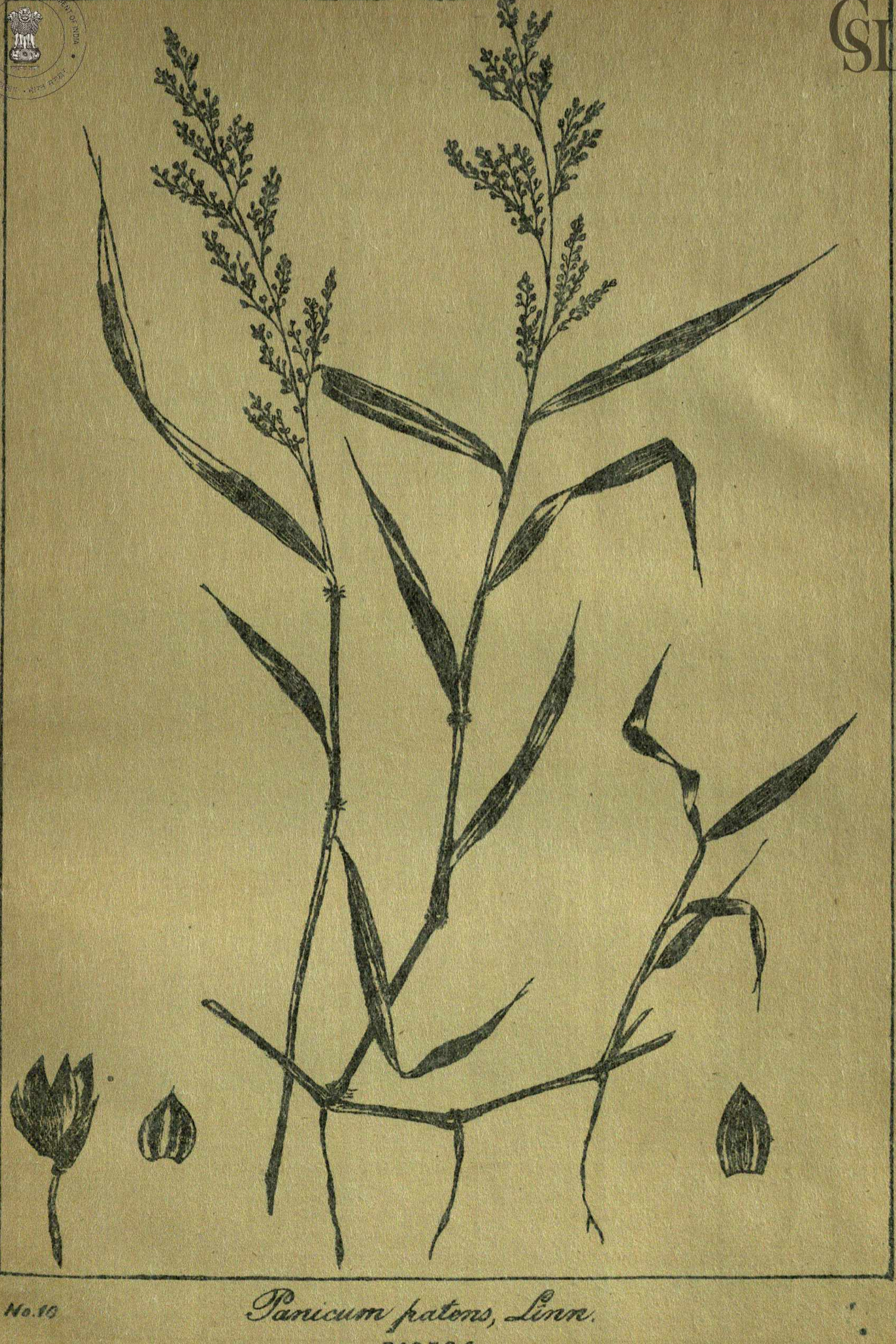
5. **THYSANOLÆNA**, Nees.

Spikelets very minute; resembling those of Panicum, but the flowering glume is thin and fringed with hairs.

This genus is represented by the following one species:—

1. T. AGROSTIS, Nees; Steud. Syn. Gram. I. 119; PANICUM ACARIFERUM, Trin. Sp. Gram. t. 87; MELICA LATIFOLIA, R. I. 328.

Culm stout, erect, covered with sheaths of leaves. Ligula ciliated. Leaves 8—20 in. by 1—2 in., glabrous. Panicle terminal, 1—2 ft. long, supra-decompound; the numerous branches and branchlets drooping or spreading, bearing subsessile spikelets; spikelets ½ line long, solitary or geminate, unequally pedicellate.



No.16 *Panicum patens, Linn.*

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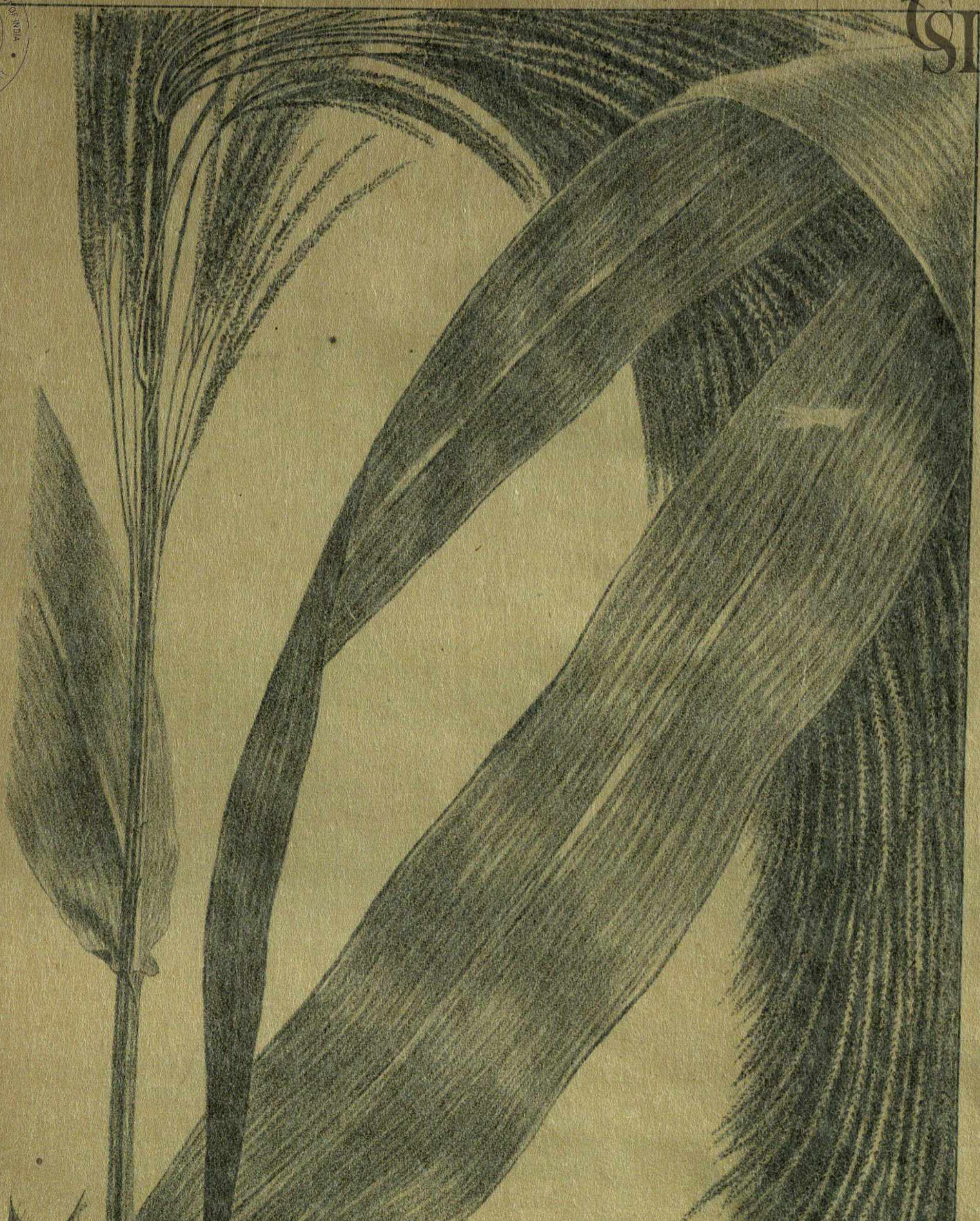

N.C.10

Thysanolaena agrostis Nees.

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Glumes green acuminate; 1st glume shorter than the 2nd, $\frac{1}{2}$ the length or a little more; the 3rd a little longer than the 2nd, 3-nerved, lanceolate. Flowering glume equal to the 3rd with long hairs. Stamens 2—3.

Habit.—This elegant grass grows in Thána, Násik, Baroda, East Khándesh, and in other parts of India; also in China and the Philippines. Specimens are to be seen in the University Gardens introduced there by the Hon'ble Mr. Birdwood. Duthie states "it is not uncommon on the plains and on low elevation on the hills, usually in the vicinity of water. The grass is called *Karsar* in Chota Nágpur."

"A decoction of the root is used as a rinse for the mouth in cases of fever."—A. Campbell. Roxburgh says: "The leaves are like the leaves employed by the Chinese to put between the boxes and lead canisters in which their teas are packed."

6. CHAMÆRAPHIS, R. Br.

Glabrous. Aquatic or marsh grasses. Spikelets with one terminal flower, usually female and a male one below it, or few on branches of a panicle, which are produced into a long awnlike bristle, beyond the terminal spikelet. Glumes 4, the lowest very small; 2nd longest acuminate, tapering to an awnlike point, many-nerved; the 3rd glume with a palea and 3 stamens or neuter; 4th glume shorter, hyaline with a bi-sexed or female flower; palea hyaline. Stamens 3. Styles free or shortly united at the base. Grain oblong, free within the glume and palea. Leaves linear or lanceolate, flat. Ligula short.

1. C. SPINESCENS, Poir; Encycl. 11, 189.

Culm creeping at the base, floating in much branched masses, 1—3 ft. long. Sheaths smooth or scaberulous, loose. Leaves linear-lanceolate, flat, 1—3 in. long by $\frac{1}{5}$ in., margins minutely spinose. Ligula transverse membrane. Panicle 2—5 in. long with rather long flexuose branches, produced in an awnlike process always longer than the spikelet $\frac{1}{6}$—$\frac{1}{4}$ in. Spikelet one or a few, each branch, distant shortly pedicellate. 1st or lowermost glume about $\frac{1}{2}$ lin. long, membranous; 2nd glume lanceolate, many-nerved, spinulose on midrib and margins tapering to a long point; 3rd glume lanceolate 7-nerved aristately acuminate with a palea and 3 stamens in the soil; the fruiting or 4th glume very short obtuse.

Habit.—40 miles east of Wagni, Bombay—Woodrow.

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7. SPINIFEX, Linn.

Spikelets polygamous diœceous. Leaves long, rigid. Male spikelets 2 ft. on rigid peduncled spikes which are spikate or arranged in umbels surrounded by bracts. Glumes 4, nearly similar not awned, 2 outer empty; 3rd and 4th with a palea or 3 anthers. Female spikelets collected in large globular heads surrounded by subulate bracts; each spikelet solitary within each bract at the base of a rachis 2 ft.; hermaphrodite, female with a male or neuter flower below it. Glumes 4 as in the males, the 3rd paleate, empty or 4th glume perfect; stamens 3 often imperfect styles 2 free to the base with long shortly plumose stigmas. Grain free within the hardened glumes. Species 4. Widely spread along the shores and Australia.

1. S. SQUARROSUS, Kunth. Enum. 175.

Vern.—*Saranto* (Goa name), *Water-pink* of Europeans in Ceylon.

Culms creeping, leafy, clothed with woolly hairs, or glabrous. The rachis of female spikes is long, spinous, so are the bracts.

Habit.—Common along the coast, also in Ceylon and Hongkong. It is a good sand-binding plant; when the seed is ripe, the long head, composed of numerous spinous processes, is detached and blown by the wind.

8. AUXONOPUS.

Has the spikelets of Panicum, but nerves of the 2nd glume broadly fimbriate, and palea of 3rd deeply cleft; 4th awned.

1. A. CIMICINUM, Retz. Obs. III. 9; UROCHLOA CIMICINA, Kunth. Enum. Gram. I. 74.

Vern.—*Sinri.*

Culm ascending 1—3 ft. high Sheaths pilose. Leaves lanceolate-acute from a cordate base, smooth, ciliated. Spikes usually 5, digitate, 2—3 in. long. Spikelet 2 or 3 together, inferior solitary. Glumes 3-nerved; 2nd glume densely ciliated on the margin.

Habit.—All over India.

9. TRICHOLÆNA.

Spikelets clothed with long silky hairs, but the fruiting glume is stiff, but not hardened as in other gramineæ. P. TENERIFA belongs to this section. TR. ROSEA, Nees, with red silky hairs on

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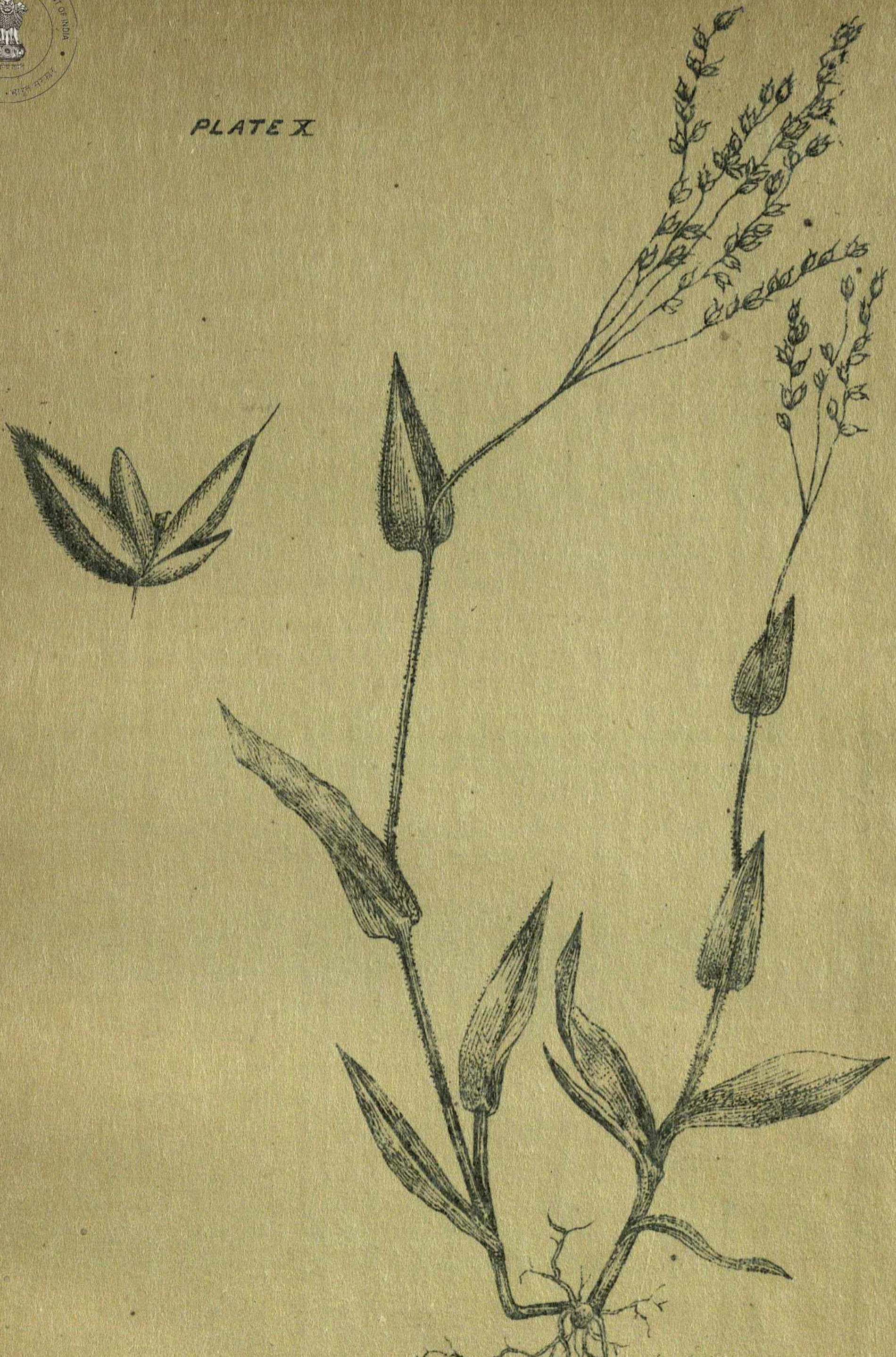
PLATE X



Drawn from Nature by M.E.R.

Panicum cimicinum, Retz.

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the spikelets, a native of the Cape of Good Hope, is occasionally found in gardens.

1. T. TENERIFFÆ, Parlatore, Fl. Ital.

Culm rigid, 1—2 feet high, bent at the base and growing from a woody foot. Nodes and sheaths pubescent. Leaves pubescent or glabrous, narrow, rigid almost subulate. Ligula ciliate membranous. Panicle 2—4 in. Spikelets solitary on capillary pedicels nearly equal to the spikelets, which are clothed with long silky hairs white or purplish. Lower glume very small or wanting; 2nd and 3rd concave, sometimes mucronate; 4th acuminate.

Habit.—My specimens are from Sind. Extends through Afghanistan to Arabia and Egypt.

2. T. WIGHTII (see my paper in Journal Nat. Hist. Society); RHYNCHELYTRENA WIGHTII, Duthie.

Culm slender, hairy, 1½ ft. high or more, bent at the base. Nodes hairy. Sheath with bulbous hairs, striated, appressed. Ligula truncated, ciliated. Leaves 5½ in. long, 2 lin. broad, pointed at the end. Panicle 3—4 in. long, branched at the lower part; common rachis seldom exerted from the sheath of the highest leaf. Spikelets on filiform 4—5 lin. long, tortuous, solitary or very seldom geminate pedicels. The lower glume 1 line long, hairy, obtuse-oblong, at a short distance from the 2nd glume; 2nd glume 3-nerved, 2—3 lines long, clothed with long, shining, silky, lilac hairs, concealing a thin short awn, which arises from the bidentate end; 3rd glume similar to the 2nd, except that it bears in its axil a palea, and a male flower. Fruiting glume small, broad, destitute of hairs, thin and rather stiff.

Habit.—This grass with dense panicle of a pink or lilac colour grows at Mahábaleshvar, Panchgani and the W. Gháts. Also in Rájputána and Jeypore, where it is known by the name of *Bard* and *Giri.*

10. OPLISMENUS, Beauv.

Characters of Panicum; but the lower empty glume is rather large and always straight awned, whilst in Panicum it is much smaller than the others and never awned. The 2nd empty glume is also always and the 3rd frequently awned.

Species 3 to 4, scattered throughout the tropical and sub tropical regions of both hemispheres (one in S. Europe).

1. O. COMPOSITUS, Beauv. Agrost. 54; O. SYLVATICUS, R. & S. System; O. LANCEOLATUS, Dalz. and Gibs. Bomb. Fl. 292.

Vern.—*Turdia, Shora.*

Culm creeping and rooting at the base, ascending to about 1 ft., pubescent or sometimes glabrous. Sheaths glabrous hairy at the mouth. Leaves lanceolate, undulated, 2—5 in. long by 1. Panicle terminal composed of distant secund branches, 1—2 in. long. Spikelets sessile, about 1 lin. long, subtended by a few long hairs. Glumes green or reddish purple 5-nerved, the lowest not much shorter than the others, but with a long purplish awn; the 2nd acuminate with a short awn; 3rd awnless with a palea.

Habit.—Lanowli, Thána up to the foot of the Ghâts. Roxburgh says that cattle are not fond of it.

2. O. STAGNINUS of Dalz. and Gibs. Bomb. Fl. is PANICUM CRUS-GALLI of Linn.

3. O. BURMANNI, Beauv. Agrost. t. 54; Dalz. and Gibs. Bomb. Fl. 291.

Vern.—*Kadak, Yerwa.*

Culm creeping and rooting at the base, the erect extremity ½—1 ft. Sheaths hairy. Leaves hairy, lanceolate and waved. Spikelets 4—8, alternate, secund, generally in pairs, 1 sessile, 1 pedicelled. Glumes hairy, long-awned. The awn of the 3rd glume rather short.

Habit.—Common everywhere, especially under the shade of trees and on cultivated ground. In the W. Indies it goes by the name of "Pagister Grass" or "Scotch Grass." The following allusion to it appears in Loudon's Encyclopædia of Agriculture:—"The island (Jamaica) abounds also with different kinds of grass of excellent quality; the artificial grass called Scott's Grass (Panicum hirtellum, fig. 199, a. p. 195), grows spontaneously in most of the swamps and morasses of the West Indies, and is so productive, that a single acre of it will maintain five horses for a whole year." According to Duthie, "in Oudh it is reported that cattle eat this grass with relish" and "............that it makes good hay." In Bombay it is also considered a good fodder for cattle.

4. O. UNDULATIFOLIUS of some botanists is O. BURMANNI.

Tribe II.—TRISTEGINEÆ, Nees.

This tribe approaches PANICEÆ, ANDROPOGONEÆ and AGROSTIDEÆ. From the first it differs by the flowering glume being thin and awned; from the second by the inflorescence and the geminate spikelets being similar to each other; from the third, by the articulation of the pedicel. Spikelet with 1 hermaphrodite flower,

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PLATE

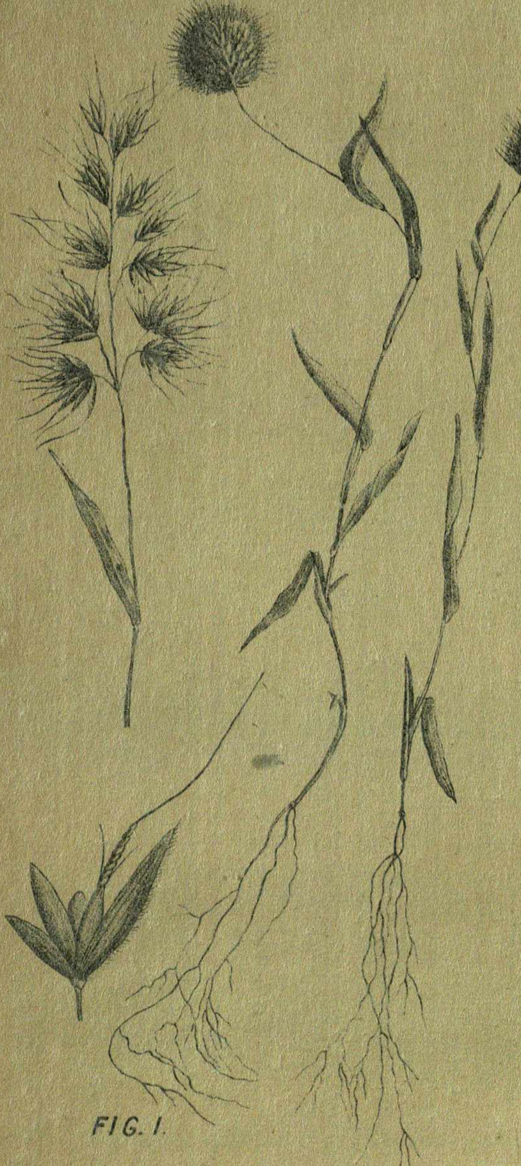

FIG. 1.

Arundinella avenacea m. m. Thw.

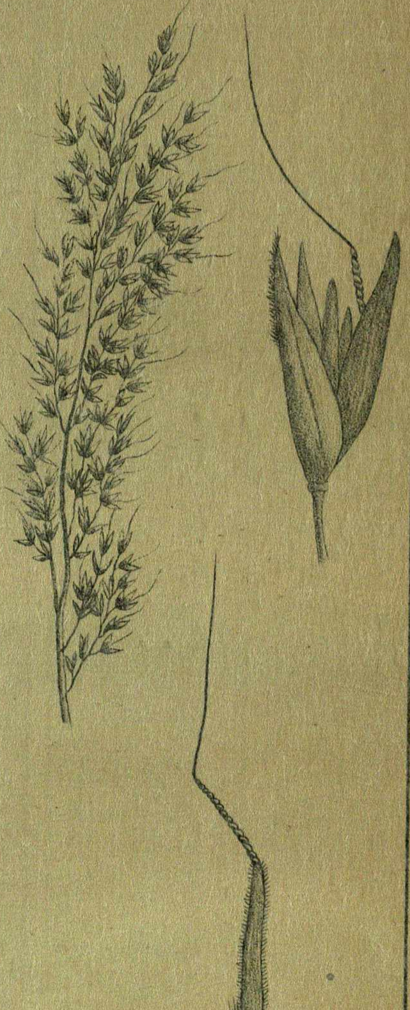

FIG. 2.

Arundinella brasiliensis Raddi.

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NO.15

DRAWN FROM NATURE BY M.E.R.

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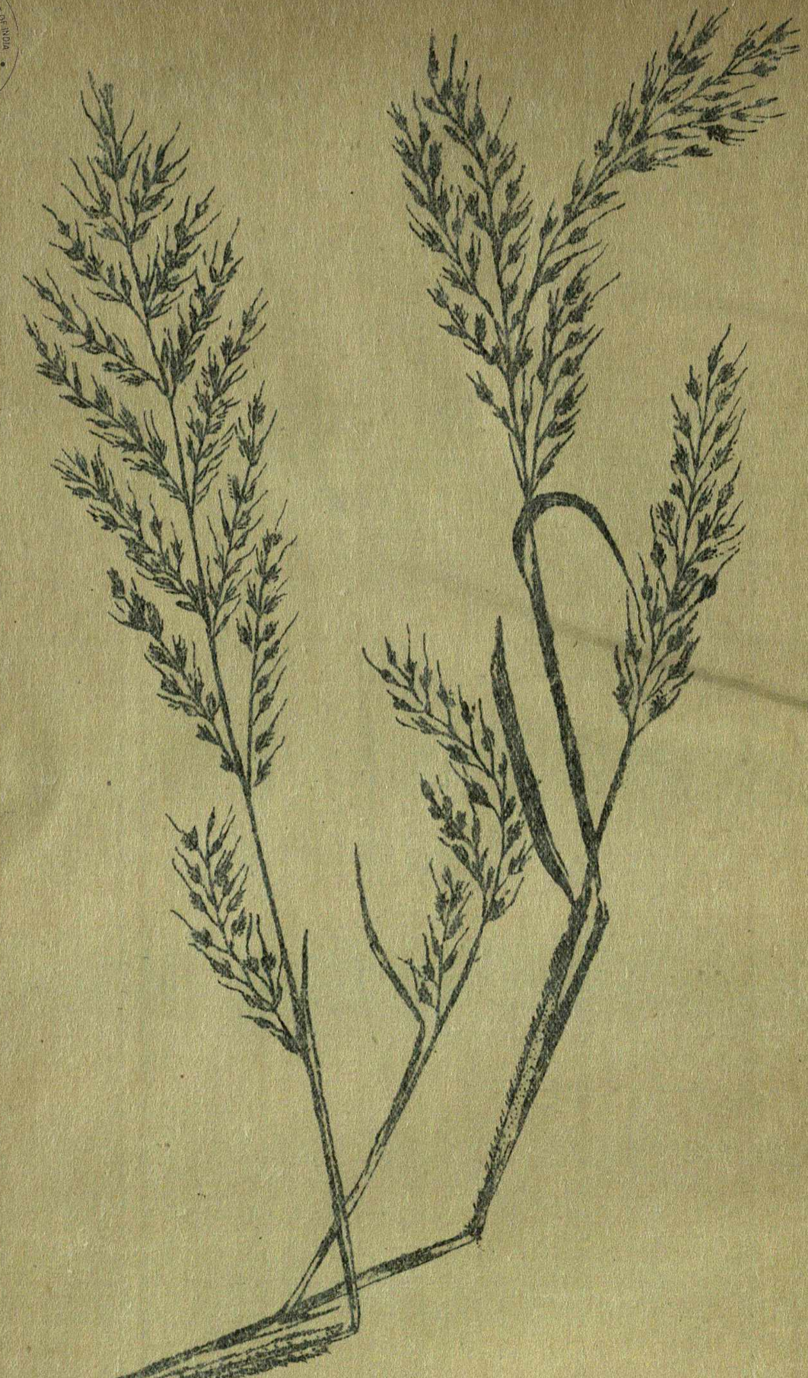

No. 14 *Arundinella tuberculata*

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or with a 2nd male flower below it in a loose or contracted panicle. Glumes 4, 2 lower empty, the 3rd sometimes with a male flower, all 3 pointed. The 4th smaller with or without an awn twisted and bent.

11. ARUNDINELLA, Raddi.

Spikelets usually in pairs, unequally pedicelled, one-flowered, or with a 2nd male flower below it in a loose or contracted panicle. Glumes 4, two lower glumes empty; the 1st short 3—5-nerved, 2nd acuminate or aristulate 5—7-nerved; the 3rd sometimes with a male flower, all 3 pointed. The 4th smaller, with an awn twisted and bent at or below the middle. Palea smaller, awnless.

Species 24 in the tropical regions of the old world, a few in America. Ten are mentioned as existing in this Presidency. Nothing is known regarding their uses.

1. A. AVENACEA, Thw. Enum.; A. CAMPBELLIANA, Lisb.

Culm glabrous, slender, rooting and branching from the base; branches 3—5 in. or more. Leaves 10—12 lines, ovate-lanceolate, acute from the cordate base, sparingly pilose. Panicle dense, ovoid compact or slightly spreading, about 1 in. long, consisting of very short racemes, congested on the top of 1—2 in. long glabrous peduncles. Spikelets geminate, unequally pedicellate. Lower glume pointed, 3-nerved with long hairs on the nerves; 2nd glume longer 3—5-nerved with hairs on the nerves; the 3rd thinner, broader and longer than the 1st, with a large palea in the axil. The 4th half the size of the 3rd, transparent with an awn 10 lin. long, arising from the top between 2 thin, hair-like processes.

Habit.—Grows at Mahábaleshvar, Castle Rock, Western Gháts and Baroda; uses not known.

2. A. TUBERCULATA, Munro, MSS.

Culm erect or slightly decumbent below, 1—1¼ ft. high, glabrous. Sheaths, leaves and spikelets densely clothed with white hairs, 1 line long from a bulbose base. Sheaths appressed, longer than the internodes. Ligula consists chiefly of hairs. Leaves 2½—3 in. by 2 lines, linear, acuminate, rounded at the base. Panicle 5—6 in.; branches alternate 1 in. long or longer, the upper shorter. Spikelets geminate, both of the same size, 1 on a short pedicel, or almost sessile, the other on pedicel 1 line long. Lower glume chartaceous, acuminate, prominently 3-nerved; 2nd, 5-nerved, also chartaceous, but broader with a long beak; 3rd equal to the lower glume, but broader and thinner, indistinctly 5-nerved,

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not hairy, but with a palea in the axil. Flowering glume smaller, transparent, with an awn arising from the top between 2 transparent bristles. The twisted part brown, the straight whitish.

Habit.—Poona and Konkan. This grass has a great affinity to A. PILOSA, Hockst., if not the same.

3. A. SETOSA, Trin. Diss. ; Steud. Syn. Gram.

Vern.—*Turdia*, *Kotir*.

Culm 3—4 ft., slender, glabrous. Sheath glabrous. Ligula hairy. Leaves $1\frac{1}{2}$ ft. long by 4 lin., hairy. Panicle 1—$1\frac{1}{2}$ ft., dense or loose ; branches verticelled or semi-verticelled. Spikelets unequally pedicelled, about $1\frac{1}{2}$ line long. Common rachis ribbed ; partial rachis and pedicels with minute stiff hairs. Lower glume with more or less distinct nerve in the middle, a little shorter than the 2nd, both pointed and clothed with short hairs ; 2nd glume 3-nerved ; 3rd thinner, as long, or a line longer than the 1st, with a few hairs on the upper part of the dorsum and a male flower in the axil ; 4th glume smaller, hyaline, with a thin twisted, bent-back awn, arising from the top, nearly double the length of the spikelet.

Habit.—Common at Lanowli, Khandála and below the Gháts. Also in Poona. Not eaten by cattle.

Almost all the species of Arundinella are called *Kotir*.

4. A. AGROSTOIDES, Trin. Sp. Gram. t. 265 ; Steud. Syn. Gram. 116 ; Hook. Fl. Br. Ind. 71.

Culms erect, tufted, simple, pubescent or glabrous, 6—18 in. high, rather stout. Sheath glabrous or hairy. Leaves linear-lanceolate, 6—7 by about $\frac{1}{4}$ in. ; upper much shorter. Ligula very short, hairy. Panicle 3—6 in. long, contracted, branches very short, fascicled, spikelets small. 1st glume $\frac{2}{3}$ of the 2nd ; acuminate 3—5-nerved ; 2nd 5-nerved, long, acuminate, almost awned 5-nerved ; 3rd acute 3—5-nerved neuter or with a male flower in the axil ; 4th oblong, lanceolate, awn bent and twisted. A variety of this is described named Cilita and pilose with larger spikelets and setose panicle.

Habit.—Deccan, Konkan, Tenasserim, Philippines and Moulmein.

5. A. TENELLA, D. 292.

This is a small grass about 1—2 ft. high. Leaves few, 1—3 in. long, broad in the middle, with a few scattered hairs. Spikelets solitary or in pairs. Panicle very large effuse, copiously

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branched. 1st glume 3-nerved ; 2nd acuminate, 5-nerved ; 3rd 5-nerved ; 4th with awn. Awn long, arising between the teeth of the end of the flowering glume.

Habit.—One of the commonest grasses at Mahábaleshvar. Grows also in the other Presidencies. When dry, not cared for by cattle. Used as an ornament in bouquets.

6. A. PYGMEA, *Hook. fl.* Fl. of Br. Ind., Kánara, Vol. VII. page 72.

7. A. METZII, *Hochst.* Hook. Fl. Br. Ind. Vol. VII. page 72.

8. A. VILLOSA, *Arn.* Hook. Fl. Br. Ind. Vol. VII. page 72. Should be found within our limits.

9. A. BRASILIENSIS, Raddi. ; A. NEPALENSIS, Trin. Sp. Gr. t. 268.

Vern.—*Kotir, Dundee.*

A tall erect grass with long narrow leaves. Ligula ciliate. Panicle narrow or loose, 1 ft. long or more ; branches rather distant from each other. Spikelets pedicellate. The 3 lower glumes 5-nerved ; the 1st a little shorter than the others ; the 3rd with a male flower. The flowering glume notched with teeth on each side of the awn, not produced into bristles.

Habit.—Mahábaleshvar, Lanowli, Khandála and N. Kánara.

10. A. FUSCATA, *Nees*; A. PURPUREA, Hockst. ; Steud. Syn. Pl. Gram. I. 115.

Culm, short stout. Leaves, short hirsute.

Panicle 4—5 in. long. Spikelet small, of purplish colour. Lower glume 3-nerved ; 2nd a little longer, 5-nerved ; 3rd glume 5-nerved. Awn of flowering glume thin, very short, twisted and bent-back.

Habit.—Only one specimen of this small glabrous grass was received from the Konkan.

11. A. CAPILLARIS, *Hook. fl* ; A. MUTICA, Nees in Steud. Syn. Gram. 116 ; Lisboa in Jour. Bomb. Nat. Hist. Soc. Vol. 5.

Culm very slender, erect, root covered with leaf-sheaths. Leaves 6—12 in., narrow, linear, acuminate. Ligula consists of hair. Panicle branches, elongated, flexuose ; numerous spikelets, solitary, glabrous, very small shorter than their pedicels ; 4th glume a short mucro like awn.

Habit.—My specimens are from N. Kánara and Poona.

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12. A. GIGANTEA, Dalz. and Gibs. Bomb. Fl. 293.

Culm stout, as thick as a good quill erect, round, about 6 ft. high or higher, branching from culm at all the joints. Nodes tumid. Leaves $1\frac{1}{2}$—2 ft. long, lanceolate, narrowed to a fine point, many nerved, glabrous or sparingly hairy. Sheaths slightly hairy. Ligule a narrow membrane. Panicle large 5—7 in.; rachis stout, angular, scabrid; branches numerous, densely crowded, slender, simple. Spikelets brownish, short, pedicels usually in pairs.

Habit.—Sálsette, below the Gháts, Kineshwar, Konkan.

13. A. SPICATA, Dalz. and Gibs. Bomb. Fl. 393.

A small grass 1 ft. high. Leaves 1—$1\frac{1}{2}$ in., hairy. Spike terminal, dense, cylindric. Lower glume 3-nerved, acute; 2nd longer, pointed, folded, concealing within its fold the awn of the 4th glume. The inflorescence resembles that of Setaria.

Habit.—Mahábaleshvar and Poona.

12. SETARIA, Beauv.

Spikelets like those of Panicum, but subtended by bristles and arranged into dense spikes. These bristles, supposed to be abortive branches, remain persistent after the spikelets have fallen off. Glumes without awns.

1 S. ITALICA, R. Br. Prod.

Vern.—*Kangni*, *Kora-kangoo*, *Kakun*, *Kang*.

Erect, 2—5 ft., sometimes decumbent below. Teeth of the leaves directed forward. Panicles dense, bending with the weight of the grain; some resemble those of PANICUM FRUMENTACEUM, others are simple cylindric lobed or compound.

Habit.—A small grain cultivated over the Gháts. Though believed to have heating properties, this millet is esteemed in certain parts both for its supposed medicinal properties as well as for eating, being used in the form of cake and as porridge. In Europe the grain is used as food for fowls and cage birds. Two varieties of it seem to exist, one straw-yellow and the other of a reddish yellow colour. The straw is not much appreciated, being considered equal to rice straw as fodder for cattle.

It is cultivated in India, China and elsewhere from prehistoric times. Dr. Watt and Mr. Duthie state that it grows wild on the Himálayas; but DeCandolle says:—"The species existed before all re-cultivation, thousands of years ago in China, Japan, and the Indian Archipelago." "Its cultivation must

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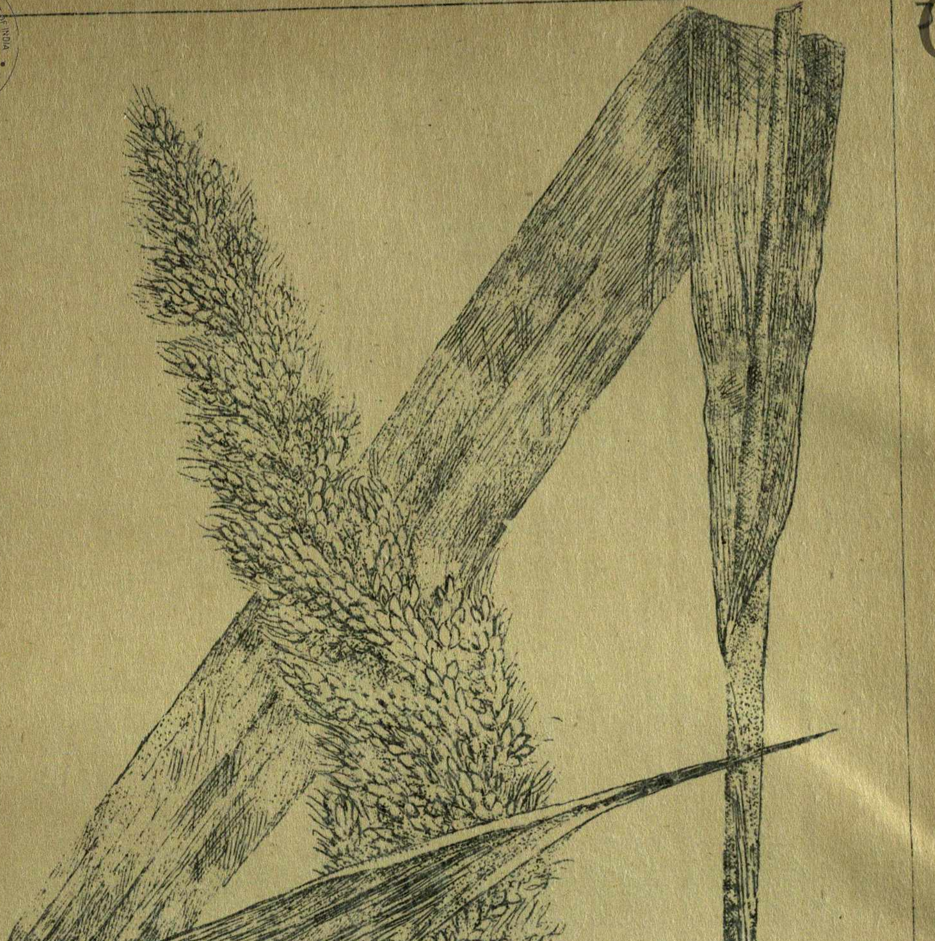

NO.16

Setaria italica, Beauv. after Trin.

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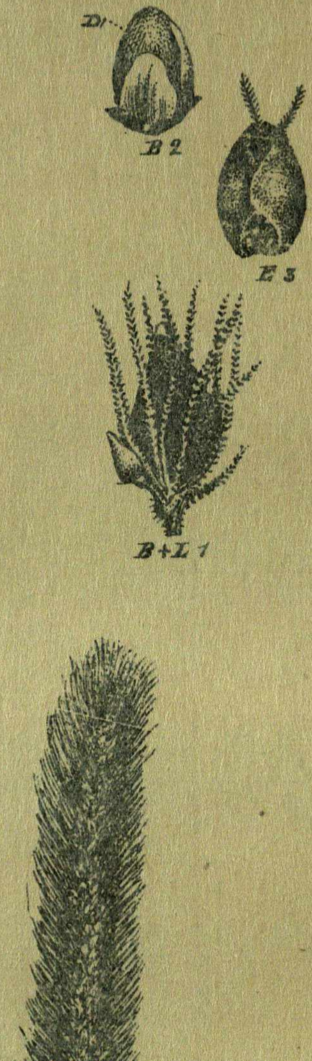

NO.17

Setaria glauca, Beauv. after Nees.

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have early spread towards the West, since we know of Sanskrit names, but it does not seem to have been known in Syria, Arabia and Greece, and it is probably through Russia and Austria that it early arrived among the lake-dwellers of the stone age of Switzerland." Mr. Hackel says :—"As early as 2700 B. C. *Hungarian Grass* (the name of this grass in Europe) formed one of the main cereals of the Chinese; it was sown in early spring by the princes of the royal house themselves, just as the emperor sowed rice with his own hands. Its culture extends back to an early date also in Egypt, and in the Lake-Dwelling of the stone age it is found in such quantities that it must be regarded as the main bread supply of the prehistoric peoples. Traces of its ancient culture are also found in other places (Hungary, Upper Italy, &c.)"

In Bombay, including Sind, the total area of the cultivation during the year 1886 and 1887 was 329,819 acres, and it is reported that it is largely cultivated in the Karnátak and in Sátára.

Professor Church gives the following composition of the grain :—In 100 parts, water 10·2, albuminoids 10·8, starch 73·4, oil 2·9, fibre 1·5, ash 1·2.

The grain is said to act as a diuretic and astringent, alleviates rheumatic pains and pains of parturition.

2. S. GLAUCA, Beauv.; Dalz. and Gibs. Bomb. Fl. 293; Trin. Spec. Gram. t. 195.

Vern.—*Birdi, Gub, Bandra, Kangni, Pingi-natchi, Naka-Kora.*

Erect, 1—3 ft. high, glabrous. Leaves occasionally with scattered hairs. Spikelets ovoid, 1—½ lin. long in a dense spike, 1—5 in. long, solitary subtended by scabrous brownish bristles beset with minute teeth directed upwards. 4th glume transversely rugate.

Habit.—Common in Gujarát, Poona, Násik, Thána, and all over India. Is a fairly good fodder grass, the seeds of which were used as food during the famine time. In the United States, where it is called "Pigeon" or "Bottle" grass, it is said to be good fodder. In Australia also it is much valued. A small slender variety is found all over Bombay with reddish-yellow awn-like hairs surrounding the spikelets. It never grows large like the larger form of the type species. It is named *Kolara* at Mahábaleshvar and Poona. It resembles SETARIA PURPURESCENS, Humb. and Kunth.

3. S. VERTICILLATA, Dalz. and Gibs. Bomb. Fl. 294.

Vern.—*Lapti, Chirchira, Bardani, Chilaya, Chicklenta.*

This is distinguished from the last species by the teeth of the bristles of the cylindrical spike being directed downwards.

Habit.—Found all over the plains and Gháts, and eaten by cattle when young. The grain is used by the poorer classes as an article of food.

4. S. INTERMEDIA, R. and S. Syst. II. 489.

Vern.—*Landgar, Chiriyaka Dana, Sawa, Lundi.*

Appears to be a depauperated specimen of S. VERTICILLATA; but the spikes are interrupted towards the base, and the teeth of the bristles are pointed upwards.

Habit.—Not common.

5. S. FORBESIANA, Hook. Fl. Br. Ind. Vol. VII. page 81.

Habit.—The Konkan—Lisboa.

13. PENNISETUM, Pers.

Spikelets in cylindrical spikes as in Setaria, but the involucre is soft; deciduous as in Cenchrus, but the bristles numerous, rarely only one, soft, not stiff nor flattened at the base; all or the middle ones are plumose.

Species 40; mostly in tropical and sub-tropical Africa, a few in Asia and America.

1. P. TYPHOIDEUM, Rich. in. Pers. Syn. 72; HOLCUS SPICATUS, D. Suppl. 99.

Vern.—*Bájri.*

Too well known to require description. Each spikelet is surrounded by an involucel of bristles, the inner ones of which are plumose and hairy.

Habit.—Extensively cultivated in the Deccan, Gujarát, Khándesh, Násik and in other parts of India and Ceylon. The grain forms the staple food of the poorer classes in those districts and in the Island of Bombay. It is extensively imported into the Konkan on account of its being cheaper than rice, which is exported. The area occupied in this Presidency is much over four millions of acres. The stalks and leaves are used as fodder for cattle, horses and sheep.

The involucre of this millet remains permanent after the flowers have fallen; this and the long filiform styles are characters which are probably due to long cultivation. The original form and its native country are unknown. It is also cultivated in Egypt, but the fruiting spikes are much smaller.

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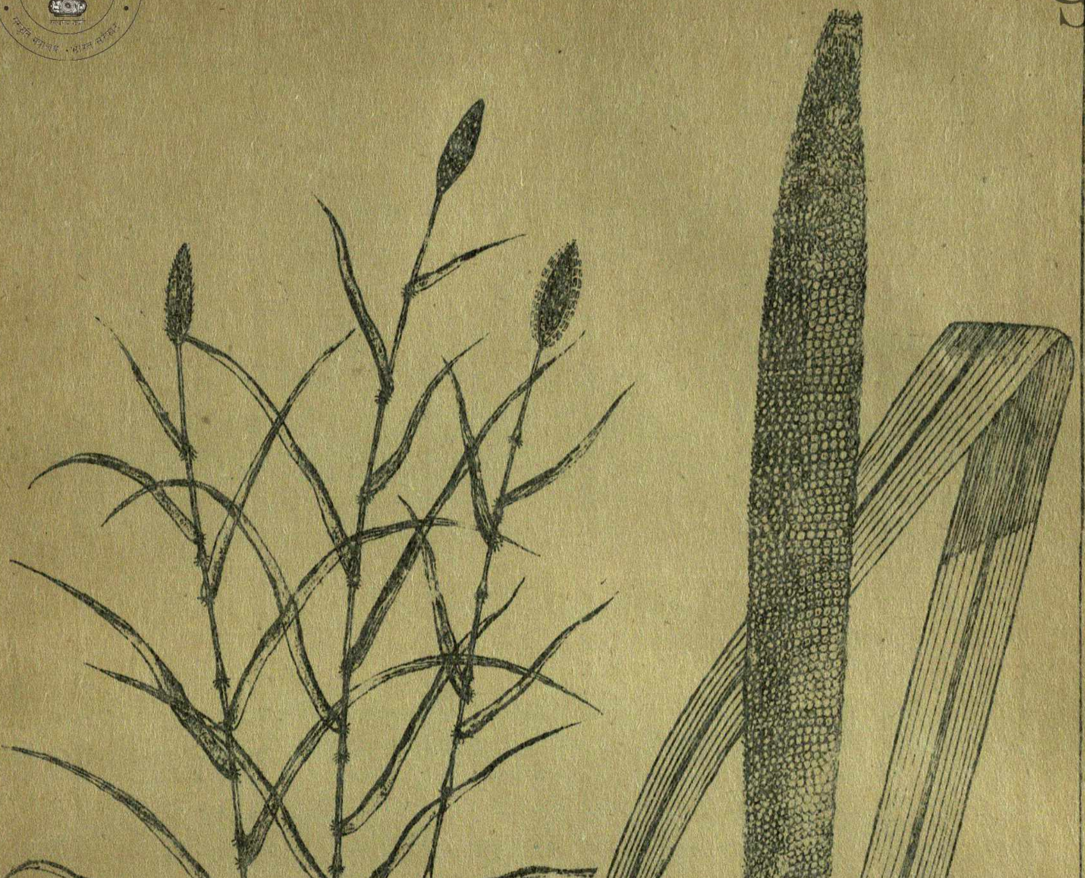

Pennisetum typhoideum Rich. (fig1) after Charch.
(fig2) after Hach

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It is a delicate crop and frequently attacked by insects. It is an important *kharif* crop in Sind, and from experiments made in the Hyderabad Farm it is ascertained that the seeds collected for sowing from the middle of the spikes yield better results.

The well-to-do classes eat the bread of bájri with butter, ghee and spices. According to Church, the composition of unhusked grain is as follows:—In 100 parts, water 11·3, albuminoid 10·4, starch 71·3, oil 3·3, fibre 1·5, ash 2·0. The ashes of this plant are used as an alkali in dyeing. I believe that the nutritive properties of the culm called *dundar* vary in different parts; whilst towards the north, they are considered to be useless in some districts of this side and in the south they are reckoned as nutritious; they are chopped and given to cattle often mixed with green fodder or *áta*. In the same way rice grass is much used in the South of India.

2. P. ALOPECUROS, Steud. Syn. Gram. 102.

Culm rather compressed, 2—3 ft. Sheaths inflated and flattened, hairy at the mouth. Leaves narrow, very tough, hairy at the base. The involucre with unequal bristles. Glumes long acuminate.

Habit.—Not uncommon in Poona, Lanowli, Násik, and in other districts. In Poona, brooms are said to be made of it, and at Mt. Abu it is employed in the manufacture of cordage.

3. P. DICHOTOMUM, Delile, Fl. Ægyp. 159, t. 8, fig. 1.

Culm much branched above, rigid glabrous smooth, branches distant sometimes fascicled. Leaves short narrow acuminate scaberulose. Spikes 2—5, cylindric solitary on the top of branches. Rachis scabrid, spikelets 2—4 in each involucre. Involucre rather hard, bristles many, bearded at the base, the longer nearly twice as long as the spikelet. Flowering glume $\frac{2}{3}$ smaller than the spikelet, acuminate; 2nd as long as the 3rd, 5—7-nerved; 4th acute short.

Habit.—Sind and Gujarát on sand hills.

P. PARVIFLORUM, Trin. Sp. Gram. t. 288.

4. P. IMBERBE, Edgew.

Culm erect, branching, glabrous. Nodes and sheaths glabrous. Leaves narrow, with a few short hairs. Spikes cylindrical, terminal and axillary. Bristles of involucre few, 1-flowered; unequal, not woolly.

Habit.—Gujarát in hedges.

Mixed with this I received specimens of what appeared to be P. PURPURASCENS, Humb. and Kunth.; P. SETOSUM, Rich.

P. LANUGINOSUM, Hochst. Rich. Fl. Abys. II. 385.

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5. P. PEDICILLATUM, Trin.

Ramous sheaths at the mouth, and leaves at the base pilose. Bristles of the involucre covered with short, very soft, woolly hairs, usually not connate at the base, but longer than the pedicellate spikelet.

Habit.—Deccan and Gujarát.

P. HOLCOIDES, Schult; PANICUM HOLCOIDES, Roxb. Fl. Ind. I. 288.

6. P. SETOSUM, *Rich.*

Vern.—*Sivati.*

Culm erect, branching, 2—4 ft., glabrous. Sheaths ½ the length of the internodes, hairy at the mouth. Ligula jagged. Leaves 8—10 in. ending in a long point, glabrous. Spikes terminal and axillary, 2—3 in. long. Involucre distant, 1-flowered (bristles alternately one twice the length of the flower and woolly from the middle downwards, the other shorter and glabrous. R. and Duthie). The inner bristles slightly enlarged at the base and connate.

Habit.—Baroda and Gujarát in general; also in Bundelkund, and Central Provinces. Uses not known.

7. P. CENCHROIDES, Rich. in Pers. Syn. I. 79.

Vern.—*Anjan Dhaman.*

Culm decumbent or ascending 1— 2ft., glabrous. Sheaths pilose at the mouth. Leaves linear, glabrous, acute, 4—5 in. long. Spikes solitary, dense, cylindrical, 1—3 in. long. Involucre sessile 2—3-flowered, alternate; bristles numerous, unequal, twice longer than the spikelets, plumose, the inner widening towards the connate base, greenish white or purple-violet.

Habit.—Common in dry soil, Gujarát and Deccan. Makes excellent fodder for cattle and horses, and believed to be useful in increasing the milk of cows. In some parts of India it is credited in having the property of imparting a slightly intoxicating effect to the milk of buffaloes grazing on it.

14. CENCHRUS, Linn.

Spikelets solitary, 2 or more, surrounded by a multifid involucre as in Setaria, but the bristles or scales, of which it is composed, are stiff, sometimes spiny and connate below, and fall away with the spikelets. Species, about 12, found in tropical and sub-tropical regions of the world.

1. C. BIFLORUS, Roxb. Fl. Ind.; Dalz. and Gibs. Bomb. Fl. 294; C. MOMTANUS, Nees in Royle Ill. Himal. Pl. 416.

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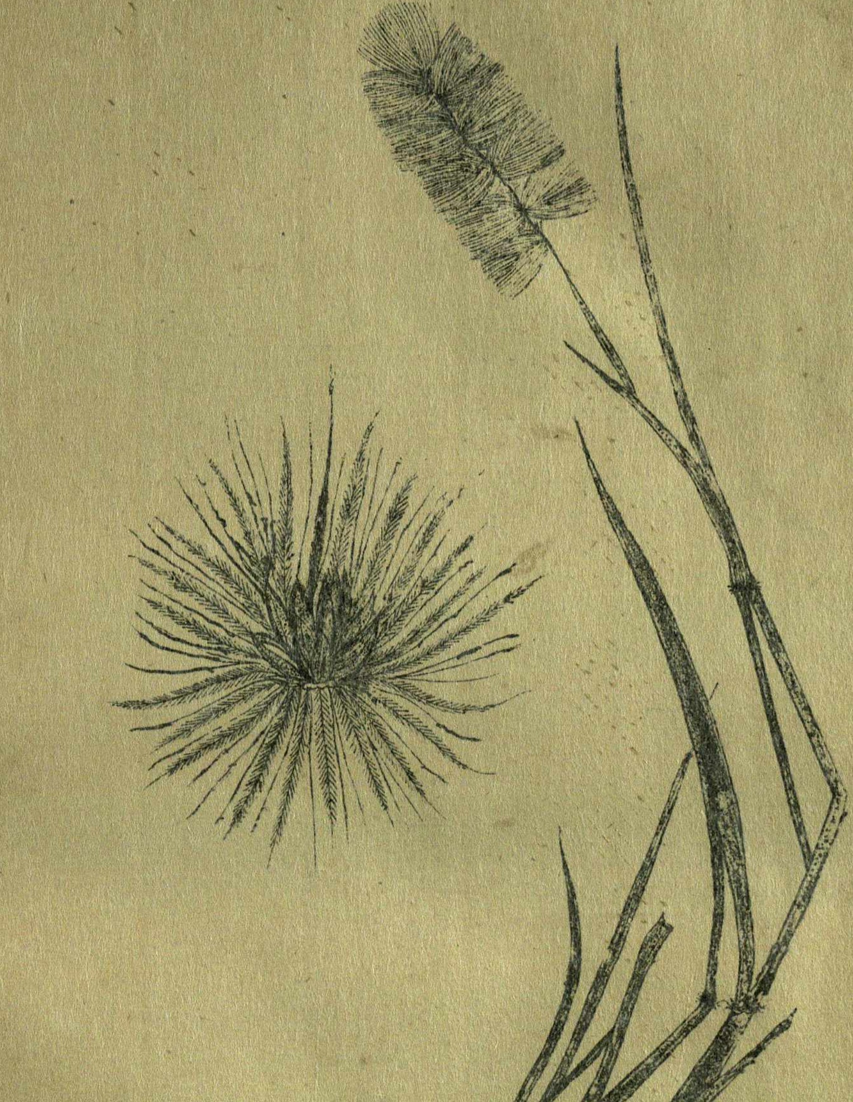
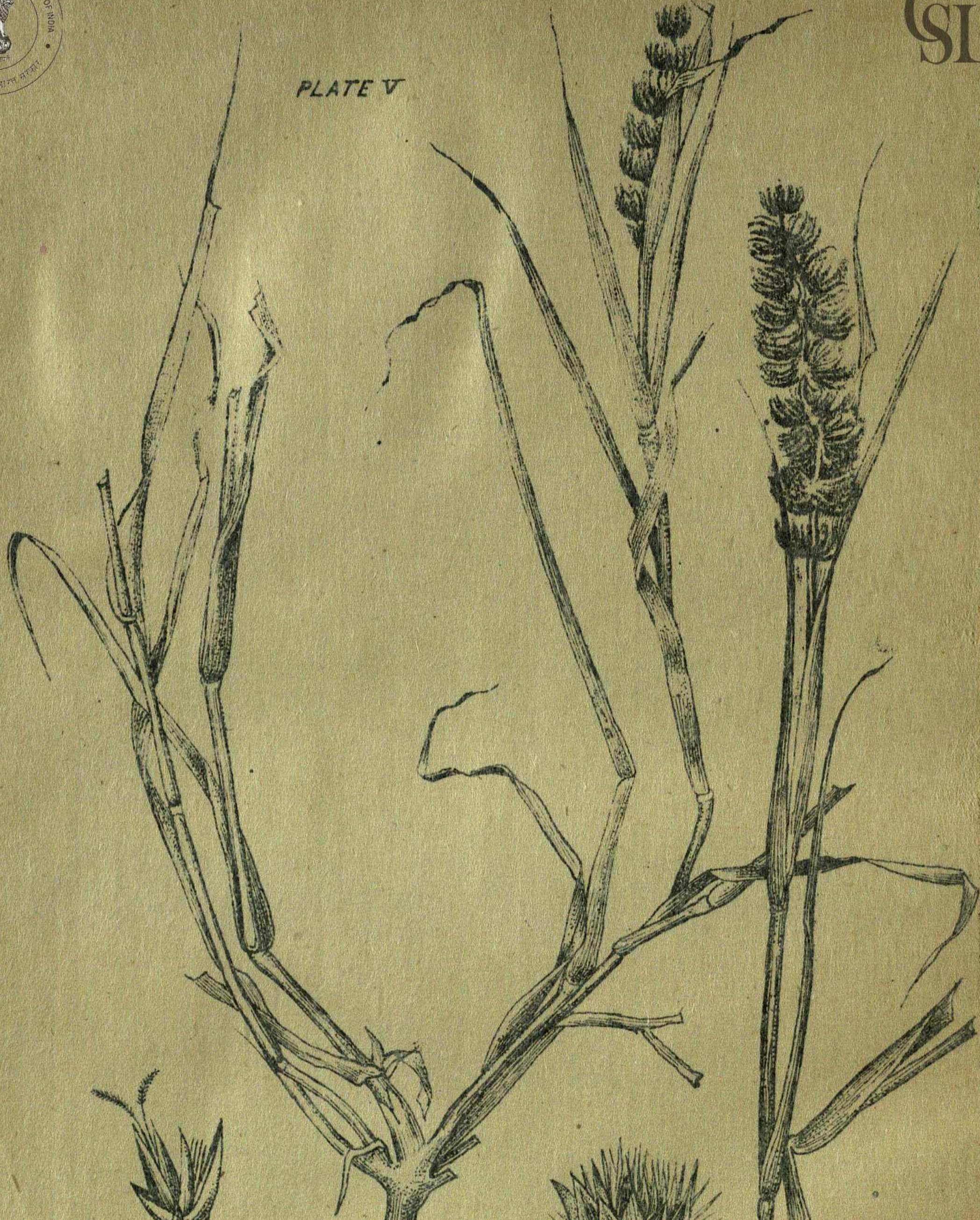


NO. 19

Pennisetum cenchroides Rich.

PLATE V



NO. 20

Cenchrus Catarticus.

Del. Analysis by Beauv.

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GSL

Vern.—*Anjan, Dhaman.*

Ascending from a procumbent base to ½ to 1 ft. or more. Sheaths at the mouth and narrow leaves sometimes hairy. Involucre hard, coriaceous, in a dense cylindrical spike, 2—4 in. long; divisions unequal, the outer shorter than the inner, connate at the base, sometimes ciliate at the margins, as long as the spikelet, sometimes hooked at the tip.

Habit.—In Násik and Gujarát, also in N.-W. India. Duthie speaks of it as "one of the most nutritious of Indian grasses, and considered by some to be the very best." It makes good hay.

2. C. CATHARTICUS, Del. Hort. Monsp.

Vern.—*Bharont, Kukar.*

Culm erect. Sheaths inflated. Leaves rough, 1—3 in. acuminate. Spike terminal, 3 in. long. Spines of the involucre sharp, connate at the base; outer division short, inner longer than the spikelet, stiff, pungent, sulcate, downwardly hispid.

Habit.—In Gujarát and in the N.-W. Provinces.

Tribe III.—**ORYZEÆ**, Linn.

Spikelets 1-flowered, articulate on their pedicels and deciduous from them. Palea 1—3-nerved. Stamens 6 or fewer.

15. **ORYZA**, Linn.

Spikelets with one hermaphrodite flower laterally compressed, sessile or on short pedicels on the branches of a terminal panicle. Glumes 4, 2 outer ones small, 2 inner ones complicate and keeled, the outer one the largest, empty, mutic or awned. The flowering glume scarcely shorter with a very short awn or none. Palea none. Stamens 6. 4th glume is by some described as a palea.

A genus of very few species, all tropical.

1. ORYZA SATIVA, Linn.

This is the well-known rice plant. Spikelets consist of 4 glumes; 2 outer, very minute or setiform; 2 inner, rigid; one of these is sometimes with a long awn.

Habit.—Cultivated everywhere. Two crops are raised annually, one during the rainy season and the other during the cold season. Rice straw is given to cattle; it is considered to be rather nutritious in South India, not so in the North used for thatching.

Rice.

About 5 or 6 wild species are described, but all may be referred to the Indian ORYZA SATIVA. Dr. Roxburgh was the first to mention it as growing in the Telegu country. Since his times

CSL

it has been found by Dr. King, Duthie and others in Orissa, Madras, Bengal, Chittagong, Assam, Mt. Abu, and according to Dr. Dymock in the swamps of Bombay.

Rice has been cultivated from the earliest times; in China from about 2800 B. C., in South Europe where it was introduced by the Arabs, and in Egypt since the Middle Ages. It is said that the reigning emperor of China sows 5 kinds of grain, sometimes only one kind, the remaining being delegated to the princes of his family.

From the cultivation carried on for such a long time, thousands of varieties have arisen. Very few men can distinguish the difference, but the cultivators and men dealing in rice readily perceive the difference of these varieties.

Speaking generally all awnless and white grains are better and more appreciated than the coloured and awned.

Rice is used for food by more people than any other grain. It is boiled and eaten with curry and also in the form of canji. Various sweets are made from it; in Japan a light alcoholic drink *saka* is prepared by means of a ferment. In China a kind of sugar is extracted from it.

A great deal of rice exported to Europe is converted into cheap gin and brandy, and starch for sizing cotton goods. In India also arrack is, I am informed, privately distilled for family consumption. According to Prof. Church the composition of rice is in 100 parts, water 12·8, albuminoids 7·3, starch 78·3, oil ·6, fibre ·4, ash ·6.

In some parts of India rice and its husks are also given to cattle and horses. The straw is extensively used as fodder in South India. It was at one time proposed to manufacture paper from it. Rice paper of the Chinese is made from *Brousonetia* or from young *bamboo*; and brooms from SORGHUM TYPICHUM.

Those who wish to have further information on various subjects cursorily touched here, must have recourse to the papers of Dr. Watt in the very useful and excellent Dictionary of Economic Products of India and to the various reports of Voelker and of the Agricultural Department.

16. HYGRORHIZA, Nees.

Only 1 species, of Indian origin, floating on the surface of water or creeping on moist ground. Sheaths of the lowest leaves much inflated. Each spikelet consists of 2 glumes only, of which the outer one is awned, enclosing 1 hermaphrodite flower. Stamens 6. No palea. Panicles umbelled. 2nd glume is considered a palea by some; it is acuminate 3-nerved.

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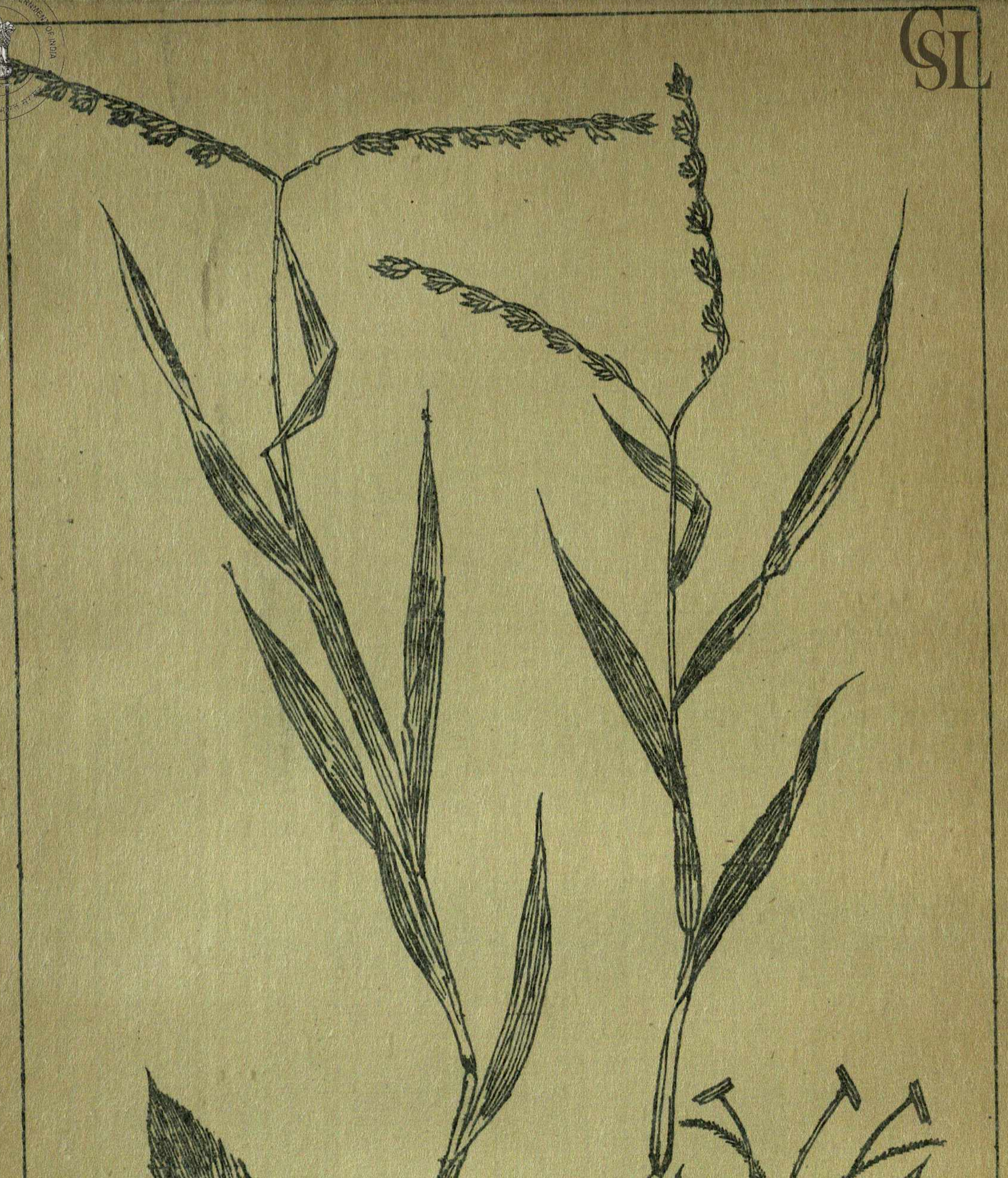

No. 21. *Trachys mucronata, Pers.*

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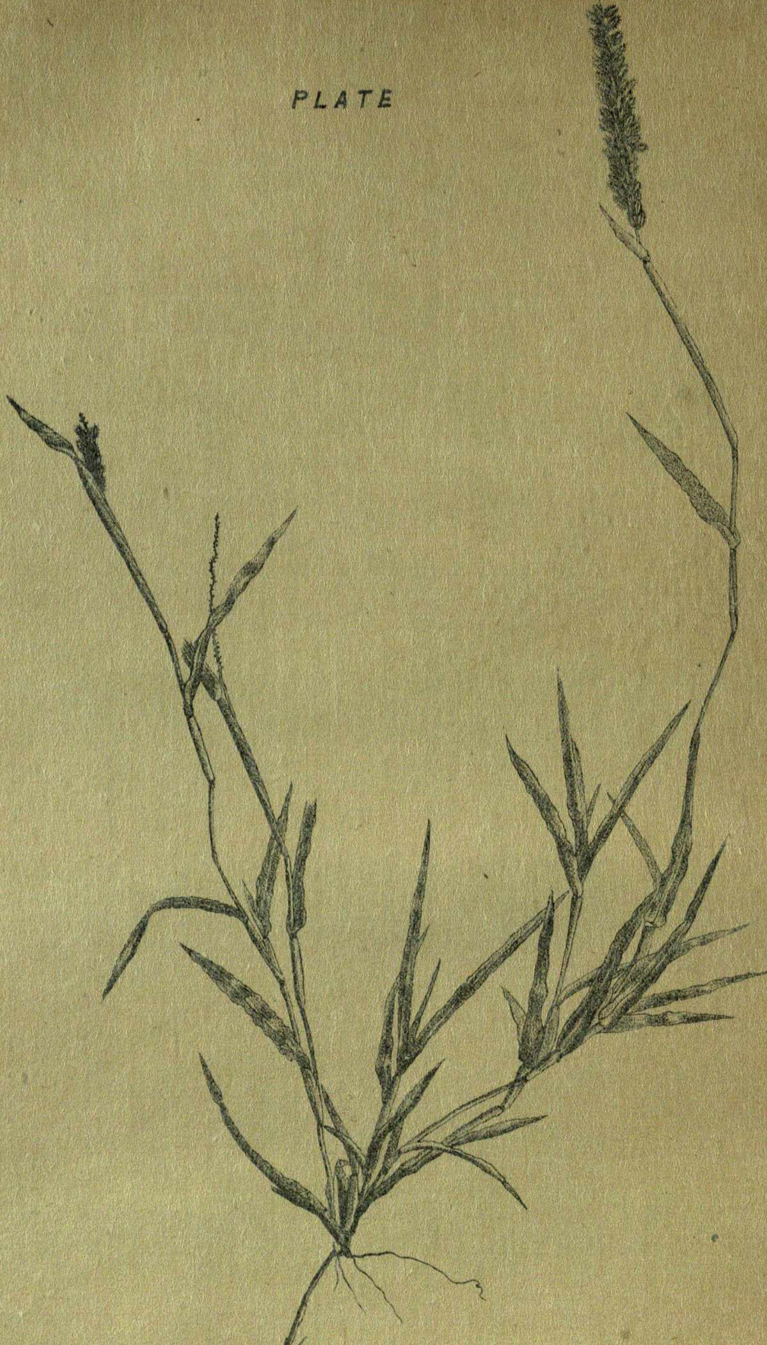
PLATE



DRAWN FROM NATURE BY A.P. CORTEZ.

Tragus racemosus. Hall.

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1. H. ARISTATA, Nees.

Vern.—*Deobhát, Urodhan.*

It is a semi-aquatic grass, easily recognized by its 2 glumes and 6 stamens without palea.

Habit.—On this side it grows in the Konkan. Roxburgh says that the grain is eaten by poorer classes, and the grass relished by cattle.

17. TRACHYS, Pers.

Spikes or racemes in pairs, occasionally solitary, terminating the culm. Spikelets in groups of 7—8; the outer spikelet male or sterile, the inner 1—3, hermaphrodite, all falling off together. Glumes 3—4, mutic; the 3rd glume very large, coriaceous. All others much smaller.

1. T. MUCRONATA, Pers.; Beauv. Agrostogr. 107, t. 21., fig. 7; Kunth. Enum. Pl. I. 168.; Retz. Obs. V. t. (PANICUM); Roxb. Cor. Pl. t. 206. (PANICUM).

Sparingly ramous. Culm bent and rooting at the lower nodes, the erect part $1\frac{1}{2}$ ft. or more. Nodes especially the lower, with a ring of soft hairs. Sheath rather lax, 1—2 in. long, pubescent. Ligula short. Blade 2—4 in. long, also soft—hairy and serrulate at the margins; pointed at the apex.

The rest as in the genus.

Habit.—Species one, grows at Bádámi, Gujarát, and all over the sea-shores of Western India.

18. TRAGUS, Hall., Stirp. Helv. II. 203.

Spikelets 1-flowered, 3—5 together on short pedicels of a panicle. Flowers hermaphrodite. Glumes 2 or 3, the lowest minute or absent, 2nd rigid armed with short hooked bristles. The 3rd flowering glume hyaline. Palea hyaline. Caryopsis enclosed in the palea and glumes, free from them. Species one, in all warm countries. The 2nd and 3rd glume readily adheres to the wool and hair of animals.

1. T. RACEMOSUS, Hall. LAPPAGO RACEMOSA, Kunth. Enum. I. 120.; Beauv. t. 6, fig. 13; Sibt. Fl. Greca, t. 101 (LAPPAGO); Hackel. fig. 66.

Vern.—*Barchente.*

Annual, $\frac{1}{2}$—1 ft. rooting at the base. Racemes slender. Spikelets elliptical-lanceolate, 2 in each cluster, one usually imperfect. 1st glume wanting; 2nd minute, membranous; 3rd rigid, glochidiate-echinate on the back; bristles hooked, 5-seriate.

CSL

Habit.—Surat, Domus, Poona, Nira, Sind, N. India, Australia. Said to be nutritious, much grazed in the rains. Considered to be good for winter feeding. Not favourably spoken of in Ajmere and some other places. Small ants greedily eat the seed, carrying the hooked husks and keeping them in heaps at the mouth of their nests, probably to prevent their small enemies from entering them.

19. LATIPES, Kunth. Enum. I. 171.

Closely allied to the last genus, contains a single small ramous species. Spikelets curved, very spiny, solitary or geminate upon a broad and flat pedicel, finally bent downwards.

Habit.—From Senegambia to Africa.

1. L. SENEGALENSIS.

Glumes 3 ; the 1st rigid, muricate on the back, empty ; the 2nd also empty, recurved-patent, muricate at the margins or on the back.

Habit.—Received specimens from Sind.

20. PEROTIS.

Spikelets 1-flowered in a simple raceme. Lower empty glumes 2, stiff and awned. Flowering glume smaller, thin, hyaline. Palea still smaller.

This genus contains 3 species spread in the tropical regions of Asia, Africa and Australia ; it is represented in Bombay by

1. P. LATIFOLIA ; Ait. Beauv. t. 4 fig. 9

Culm 1—1½ ft. high. Leaves hairy, about 1 in. long. Racemes peduncled, 2—4 in. long. Spikes 1-flowered. Awns slender, usually ½ in.

Habit.—Widely diffused over Bombay, tropical Asia and subtropical Africa, Cape of Good Hope, China, and Japan.

21. ZOYSIA.

It is limited in India to a single species—

1. Z. PUNGENS ; Kunth. Enum. I. 471 ; Beauv. t. 21, fig. 7.

Culms creeping and shortly ascending. Leaves narrow, pointed, sometimes pungent, ½—1 in. long. Spike 1 in. long. Spikelet 1-flowered, closely appressed, awnless, almost sessile. Glumes 2 ; lower keeled, coriaceous, acute or acuminate, embracing below the 2nd glume.

Habit.—A common sea-side plant growing in tropical and subtropical Asia, Masurene Islands, Australia and Japan. Creeps to a great length and serves to bind the sands along the coasts.

My specimens are from Damaun.

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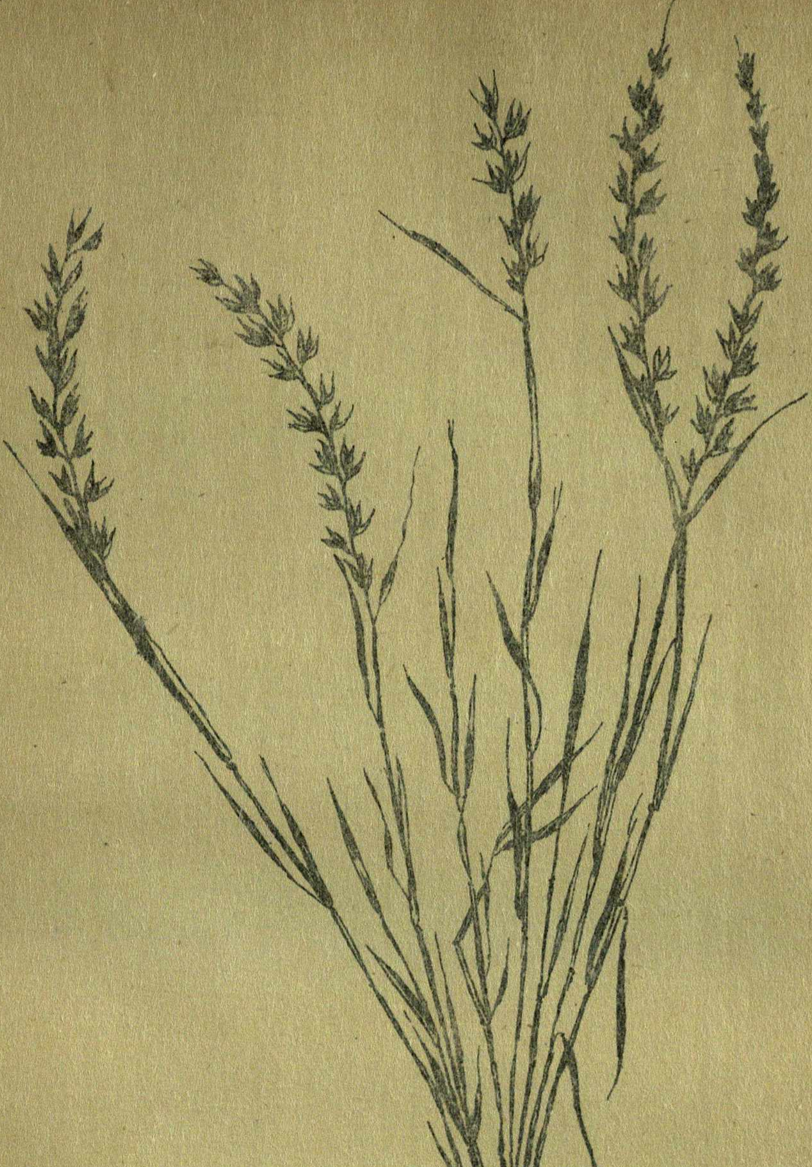

No. 23

Latipes senegalensis, Kunth.

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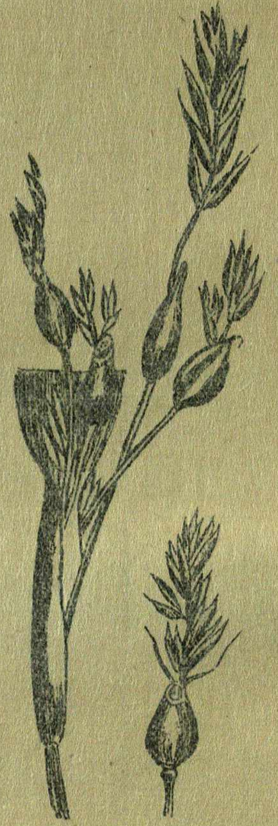

No. 24.

Coix lachryma-Jobi, Linn.

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Tribe IV.—ANDROPOGONEÆ.

Spikelets in pairs or terminal threes (solitary in Dimeria, and in some species of Arthraxon and Ophiurus), one sessile and fertile, and 1 or 2 pedicellate, male, neuter or rudimentary. Flowering glume often with a twisted awn. Palea smaller and thin.

22. COIX, Linn.

Spikelets monœcious, the fertile ones at the bottom of the spikes, enclosed in a stony, glossy, white involucre, formed by a sheathing bract; upper spikelets male, drooping. Flowering glumes membranous, acute.

There are 3—4 species in India and China, one of which, "Job's tears" grass, is common all over India and now spread throughout the tropics.

1. C. LACHRYMA-JOBI, Linn. D. 289.

Vern.—*Rán-jondhla, Bánmaka, Kassar, Kardia, Gurgur, Keruch.*

A tall coarse stout 3—5 feet grass common in wet places. Leaves broad 4—18 in. by 1—2 in. Male spikes loose arising out of a coriaceous involucre enclosing female flowers consisting of sheathing bracts; this in time becomes stony and pearly-white enclosing the fruit. The fruits called *Job's tears* by Europeans and *Kassaibij* by natives are used as a diuretic; and also as an article of food by the hill tribes, by Chinese and Burmese. For this purpose it is well pounded. Said to be cultivated in China, because the fruit is reckoned as a good diuretic and anti-phthisical. Catholics use the hard involucres as beads for rosaries.

Habit.—Throughout India.

23. POLYTOCA, R. Br.

In Benth. Pl. Jav. Rar. 20, t. 3; Steud. Syn. Pl. Glum. I. 10.

Terminal spikes consist of male flowers; axillary androgynous; male occupying the upper part and the female the lower, the rachis between the latter articulate. Male flowers in pairs, 2 outer glumes empty, the outermost long, acuminate or awned. Stamens 3. Female flowers also geminate, one stipitate, sterile, with 4 or less number of glumes, the other fertile sessile in the excavation of the articulate rachis, with 4 glumes; the outermost long and broad, completely enclosing the narrow joints of the rachis.

Habit.—Species 5; 4 are in India and one from Louisiade Archipelago.

Uses not known.

1. P. Cookei, Staff. Sp. Nov.

Culm 2—6 ft.; excepting this, all other parts studded with long (1—2¼ lin. long), strong, pungent hairs. Sheaths lax, about 4—6 in. long. Nodes with a ring of white soft hairs. Ligula short, membranous, pilose. Blade linear lanceolate, about 1—1½ ft. long or longer and 1¼ in. broad, gradually narrowing at the base and terminating at the upper end into a point. Nerves many, the central on the lower surface prominent and white. Peduncles bearing flowers usually 2 in each axil, very slender, of unequal length, subtended by a leaf, the sheath of which is 1½ in. by ½ in. and the lamina 2½ by ⅛ in. The terminal peduncle bears spikes of male flowers only, the lower peduncle supporting mixed spikes; these are enclosed like those of Polytoca barbata, in a spathe-like bract, long cuspidate or acute pointed. Male flowers in pairs, one pedicellate and one sessile. Glumes 4; anthers 3; lodicules 2. Rudiment of ovary none. Female flowers geminate, one pedicellate and sterile and one sessile and fertile. Rachis 3-jointed, sometimes 5—6, rather flattened, with stiff hairs on one side, each joint bearing at the upper end a small cup-like excavation, into which the succeeding joint fits. Pedicillate flower consists of one or 2 glumes only, similar to those of the male flowers and their pedicel adnate to the base of the excavation. The 1st glume of the sessile flower rather cartilaginous, 3-toothed, large and long and enclosing the 2nd glume and the rachilla. The 2nd and the 3rd are nearly equal. Flowering glume shorter, hyaline. Palea ⅓ shorter than the 4th glume. Stigmas long.

Habit.—Found growing in the forests of Sálsette by Jacquemont and Dalzell; in Mahábaleshvar by Woodrow, Oct. 1893, in a locality confined to about an acre near the road leading to Mahád, and in the Konkan by Hook. and Th. (Herb. Ind. Or. Hook. f. et Th.); in S. Konkan and in Kánara. Dr. Lisboa com. in 1891 (Kew Bulletin).

This grass was discovered by Mr. Woodrow, and named after Dr. T. Cooke, late Principal of the Poona College of Science.

2. P. barbata, *Stapf.*

Vern.—*Varival, Kawdia, Karang, Gurgur.*

Erect, 3—6 ft. high. Sheaths scanty, hairy. Leaves 2—3 ft. long, hairy. Spikes terminal, axillary.

Habit.—Common on wet ground. Said to be used as fodder at Bálághat. Rosaries are made of the stony fruits of this and of the last grass.

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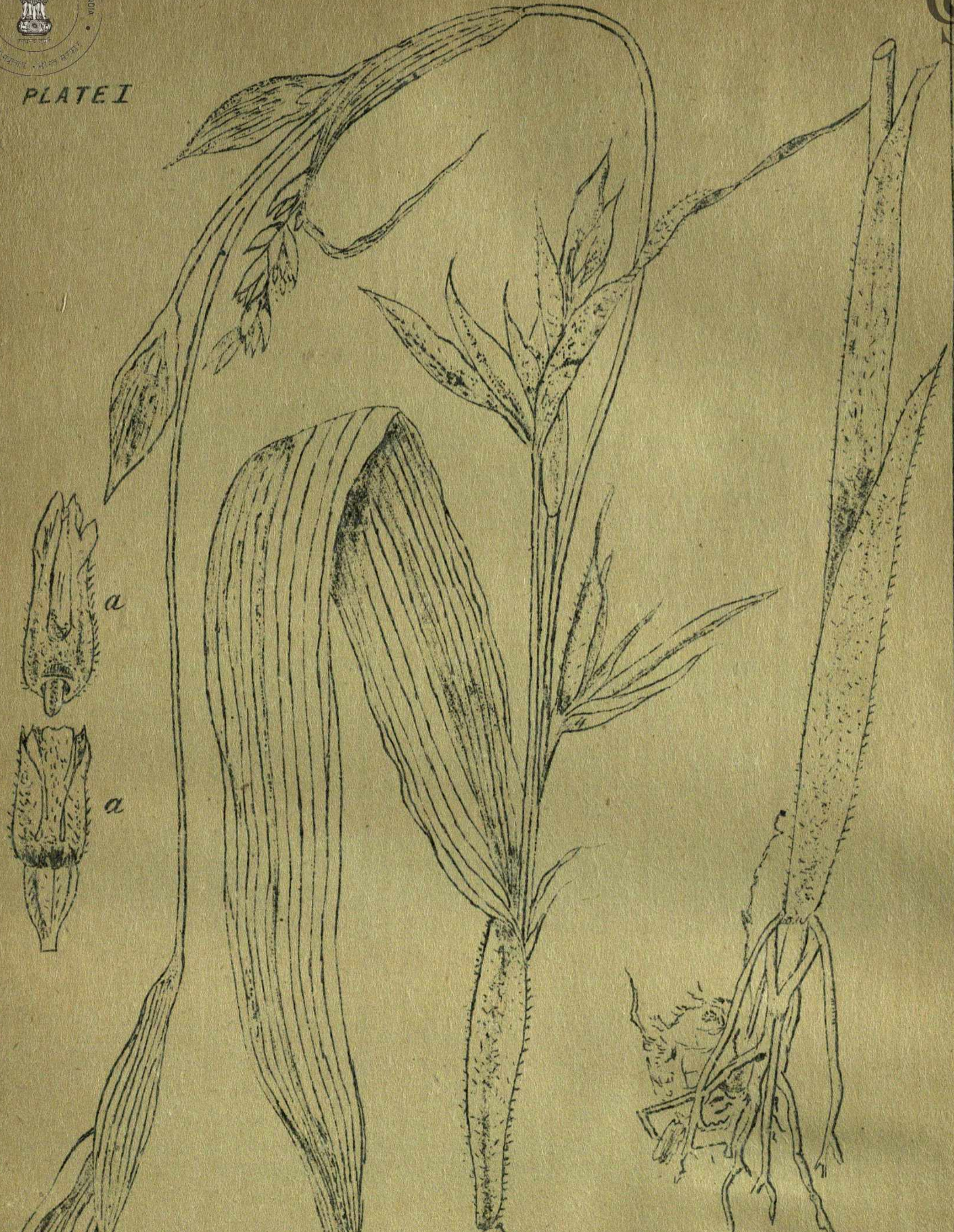
PLATE I



No. 25 Polytoca Cookei, Stapf. Sp. Nov.
a. a. articulation.

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24. ZEA, Linn. Gen.

Contains a single species of American origin, but at present cultivated in various warm and temperate countries.

1. Z. MAYS, Linn.

Vern.—*Boota, Macka, Bari Joar, Bonda* (Mar.), *Makai, Indian Corn, Maize.*

This plant is too well known to require description. The male organs are terminal, and the female spikelets below, packed in several vertical rows round a central thick axis, and their long filiform styles protruding from the top of large bracts in which they are wrapped. It is cultivated everywhere in this and in the other Presidencies. Sown "in the early part of the rains, specially near large towns, where it affords a choice food for all classes, being sold ready roasted. The plant is also sown in the cold season, but more frequently in the beginning of the hot season (March) to afford a forage to cattle called *Kuddol.* At this time it is sown only for the straw—therefore very close. The grain is seldom used in India for flour. Several large varieties of maize have at different times been imported from America, but these gradually degenerate to the size of the common country species" —Dalz. and Gibs. The stalks and leaves when young afford excellent fodder for cattle.

The following short extract is copied from Hackel :—

"The very nourishing meal is made into mush ('Polenta') by boiling, but its exclusive use gives rise to a skin disease ; it is also made into cakes ('Tortillas' or Tortilhas), and sometimes mixed with wheat flour or wheat and rye, to make bread ('Brown bread of New England'); good bread is made in Portugal and Spain. The unripe ears are roasted or pickled in vinegar as a vegetable ; from the fruit the natives of South America prepare an alcoholic drink ('Chica'); another ('Pulque de Mahiz') is made in Mexico by the fermentation of the very sweet sap that is pressed out of the stem. In North America, efforts have been made to make sugar from this juice. The boiled fruit makes an excellent food for swine and poultry ; and the entire plant, even the straw, is an excellent fodder for cattle. The husks are used for making paper as well as for hats, matting and for filling beds, &c. The large variety (horse-tooth maize) as well as that with striped leaves is used for lawn decorations in ornamental gardening. Maize was imported into Europe soon after the discovery of America, at about the same time that Northern Europe received buckwheat from Central Asia and Russia. In view of the wide distribution it had attained when America was discovered, and the manner of its cultivation, its culture in this country must be very ancient, though older discoveries are wanting, since the finding of maize-kernels in the renowned graveyard of Ankon in Lima is not reliable for determining its antiquity, for those graves were evidently used after as well as before the discovery of America."

EUCHLÆNA LUXURIANS, Schrad. Ind. Sem. Hort. It has the habit of Zea. The male spikelets in terminal panicles and the female below enclosed in bracts with long filiform styles protruding through them. The resemblance is such that Zea is believed to be a cultivated form of Euchlæna.

The cultivation of this plant requires a rich soil and abundance of water. Is highly valued as fodder in some parts of the United States.

25. DIMERIA, R. Br. Prod.

Spikelet 1-flowered, inserted singly on the alternate notches of unilateral terminal spikes, which are 1, 2 or 3 together. Glumes 4, two lower glumes keeled, unawned, the 3rd also empty, hyaline. Flowering glume notched or 2-lobed with a twisted and bent-back awn. Palea minute or none.

Species 13; the Indian species are small and slender. Uses not known.

1. D. HOHENACKERI, Hochst.

Culm slender, ascending ½—1 ft. Nodes pilose. Sheaths ciliate at the margins. Leaves with hairs papilose at the roots. Racemes 2—3, filiform. Glumes unequal, chartaceous, clothed with fine hairs.

Habit.—N. Kánara and Mangalore.

2. D. ORNITHOPODA, Trin. ANDROPOGON FILIFORMIS, Roxb. Fl. Ind. 256. Var. D. TENERA.

Culm filiform, about ½ ft., decumbent. Nodes sparingly hairy. Sheaths and leaves ciliate with more or less long hairs. Spikes 2, sometimes 3, 1 in. long. Glumes unequal with a few hairs or ciliate from the margins.

Habit.—Mahábaleshvar and Lanowli, also in Poona. In the latter place not uncommon. Also all over India.

3. D. WOODROWII, Stapf.

A tufted annual. Culm 1½—3½ in. high, slender, glabrous, simple, covered with leafy sheaths. Nodes with short hairs. Leaves narrow, 2—2¼ in. long, hairy at the base. Spikes or rather racemes arising from the top of a solitary pointed sheathed

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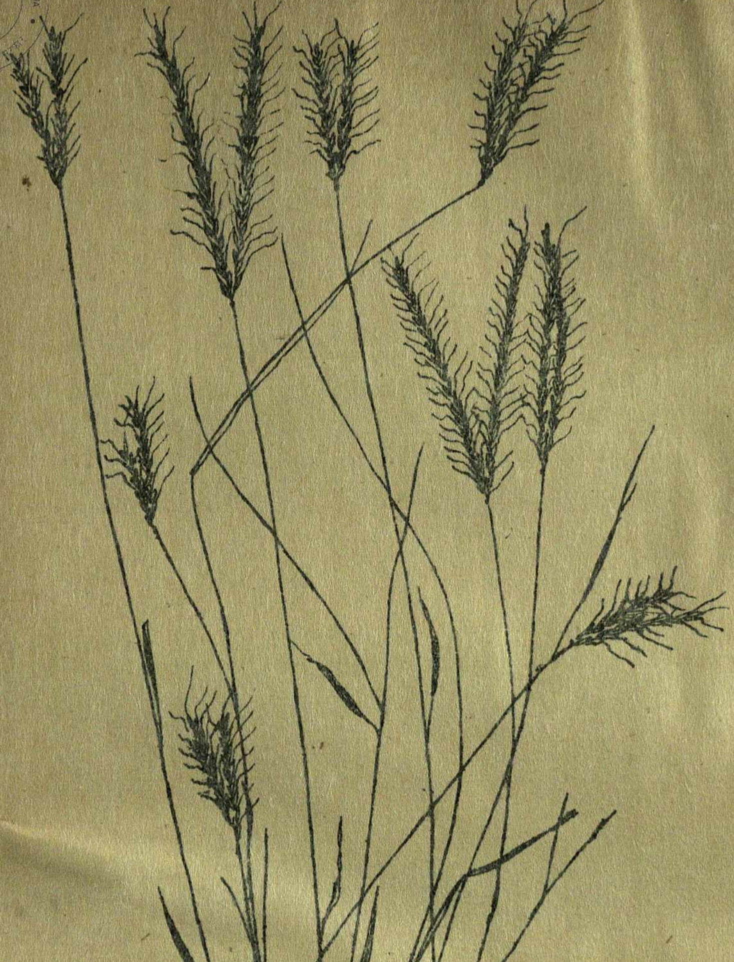

No 26. *Dimeria ornithopoda, Trin.*

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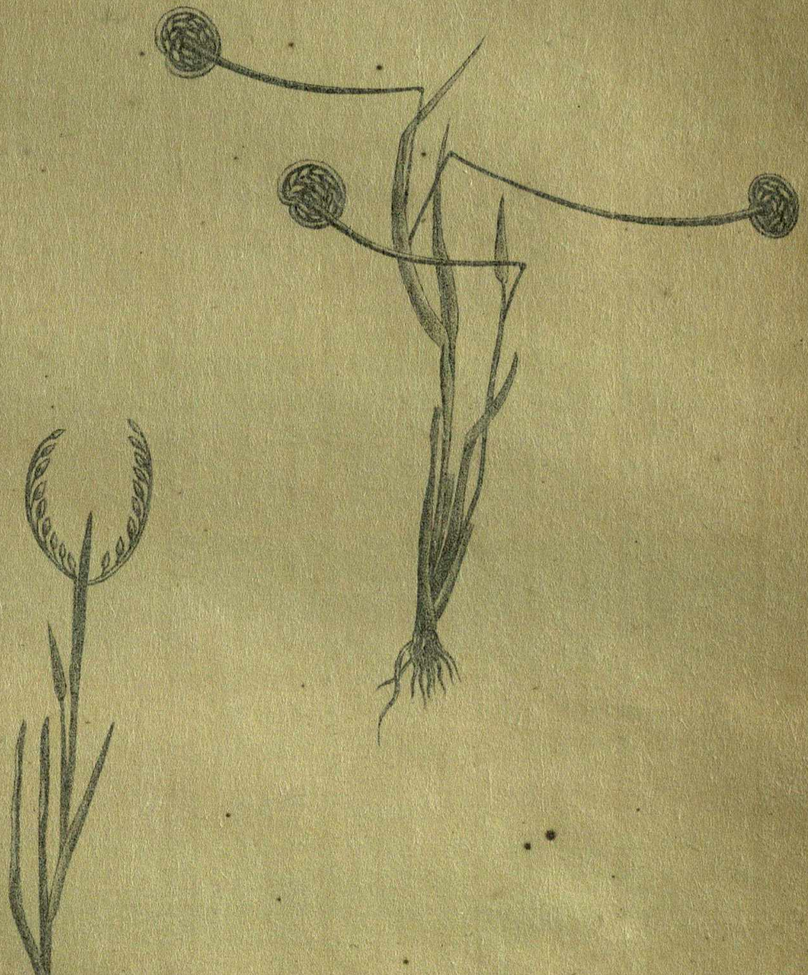
PLATE



DRAWN FROM NATURE BY H.E.B.

No. 27 *Dimeria Woodrowei, Stapf.* SP. NOV.

PAGE 11

peduncle, 2, close to each other, circinately curled, so as to form a sort of a small ball; when unfolded, each spike, 1 in. long, bears on its inner surface short-pedicelled spikelets. The peduncle bends back when the inflorescence is ripe. The broad surface of the rachis turned outside. Pedicels surrounded with a tuft of white hairs as long as the lower glume. Glumes hairy on the keel, unequal. Awn of flowering glume protruding to about $\frac{1}{4}$—$\frac{1}{3}$ lin. above the flower. Stamens 2. Stigma plumose.

Habit.—This curious grass was collected near Ratnágiri, and accurately described by Mr. Woodrow, Professor of Botany and Agriculture of the Poona College of Science.

4. D. FUSCESCENS, Trin.

Culm slender, 14—16 in. high, glabrous, sheaths with or without a few hairs at the mouth. Leaves linear, 2—3 in. by 2 lines, rigid with numerous hairs. Racemes 2, rarely 3, 2—2½ in. long, 1 sessile and the other on a peduncle 3 lines long, enclosed in or emerged from the last sheath; 1 raceme is often branched. Spikelets on distant very short pedicels, of light brown-yellowish colour, 2—2½ lines long. 1st glume rather rigid; 2nd a little longer and broader, both ciliate at the margins; 3rd smaller, no hairs; 4th nearly the size of the 3rd, awned.

Habit.—Lanowli in the field in front of the bungalows of the G. I. P. Railway employés. Also in Bengal, Kassia and Nepal. Uses not known.

5. D. GRACILIS, Steud. Syn. Pl. Glum. I. 413.

Small grass with filiform culm, nodes bearded with fine hairs. Spikes 3—10; length 1½—3 in; pale red brown or yellowish white.

Habit.—Rare over the Ghâts. This and the last found growing among other grasses, specially by the side of ARTHRAXON ECHINATUS and have a peculiar withered look in consequence of their light brown or yellowish white colour of inflorescence.

26. IMPERATA, Cyr.

Rachis of the panicle not articulate in this and in MISCANTHUS, an exceptional character in the tribe. Spikelets 1-flowered, awnless in dense, cylindrical spike-like panicle. Glumes transparent, membranaceous, the 2 lower keeled, densely clothed with long silky hairs. Flowering glume and palea shorter. Stamens 1—2. Anthers large, linear. Stigmas long exerted.

Species 12 throughout the tropical and sub-tropical regions.

1. I. ARUNDINACEA, Cyr.

CSL

Vern.—*Dhub.*

Easily recognized by its pure white cylindrical spikelike panicle. In external appearance it resembles SACCHARUM SPONTANEUM, and is known to natives by the same vernacular name.

Habit.—In moist places all over our Presidency, also in Sind North-West Provinces, Punjáb, very common in Bengal, ascending the Himálaya up to 7,000 ft. high. Widely dispersed over N. India, both on the hills and plains, more especially on clayey soils, when water is near the surface. It forms a very large portion of the pasturage in Bengal, where, as Roxburgh observes, the fields are white with it when in flower after the first rains in April and May. Cattle relish it when young. The Telingas make use of it in their marriage ceremonies. In Australia it is called "bladey grass;" and the young succulent foliage, which springs up after the occurrence of a fire, is much relished by cattle. "I have observed the same effect resulting from periodical fires on certain parts of the Himálaya where the grass is plentiful."—Duthie. Fibre extracted from the culm is used for the same purpose as that from SACCHARUM CILIARE, *Munja,* namely to prepare the sacrificial thread of the Hindus. The rind is employed for thatching in Bengal Burma and Ceylon.

27. **SPODIOPOGON**, Trin. Fund.

Racemes panicled with long peduncles, 2 to 4 (rarely many) jointed, spikelets 2 at each joint, one pedicelled and one sessile, both biflorous, rarely 1-flowered; upper flower hermaphrodite, awned; 1st glume keelless, prominently 5—9-nerved; 2nd glume equal to the 1st or adnate; 3rd glume with a male flower in its axil, rarely empty; 4th or the flowering glume awned from a deep notch; palea as long; lodicules cuneate truncate; caryopsis cylindric or nearly so.

Usually tall grasses of the old world. Species 5.

S. ALBIDUS, Benth.

Culm 1—3 ft. Leaves on a distinct petiole, $\frac{1}{2}$—1 in. long, pointed and with a few soft hairs; midrib prominent. Both spikes similar.

Habit.—N. Kánara, throughout India, not common. My specimen is from N. Kánara.

28. **POLLINIA**, Trin.

Spikelets 1-flowered in pairs, one sessile the other pedicellate, both fertile, arranged usually in digitate racemes. Rachis articulate. Flowering glume awned.

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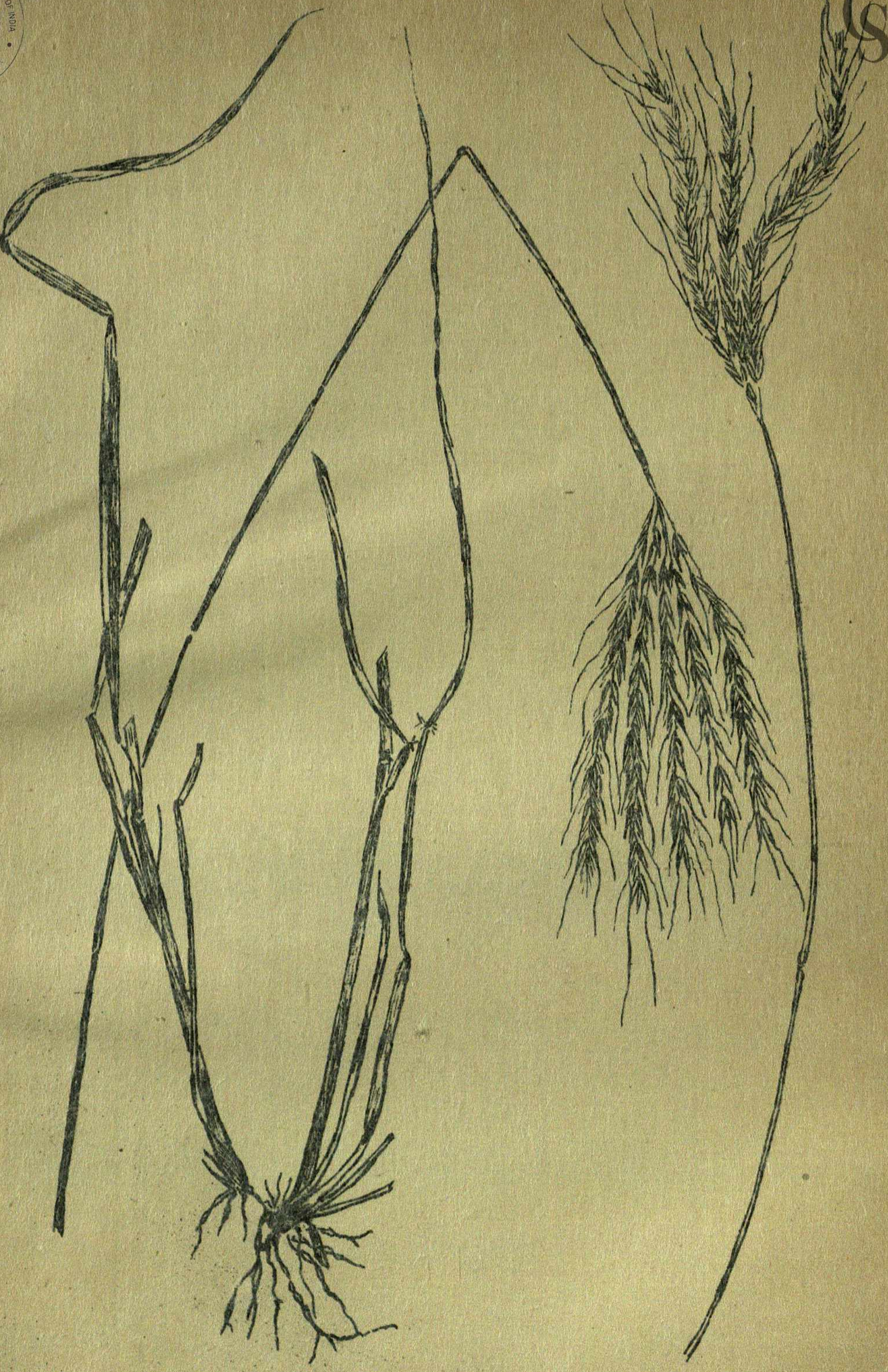

No. 28

Pollinia argentea, Trin

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1. P. ARGENTEA, Trin.

Vern.—*Roira, Chota Kussal, Krer.*

Culm 1—3 feet erect. Sheaths ciliate at the mouth. Leaves hairy. Spikes 2, or many, clustered at the summit of the peduncle, 2—4 inch long. Rachis of the spike and the pedicels of the spikelets surrounded by silky hairs.

Habit.—This beautiful grass is common at Lanowli and all over the Presidency, and in other parts of India. Eaten by cattle when young. Used in Poona for brooms and thatching.

29. SACCHARUM, Linn.

Tall grass with large panicle. Spikelets 1-flowered in pairs, awnless, surrounded by long silky hairs, specially on the callus, both sessile or 1 pedicellate; the rachis articulate. Two outer glumes empty and keeled. Flowering glume and palea, smaller, thin and transparent.

1. S. SPONTANEUM, Linn.

Vern.—*Dharbi, Dhub, Kan, Bochri.*

Easily recognized by its long white panicle, care being taken to see that the long hairs surround the base of the spikelet and do not arise from the glume.

Habit.—Common in Sálsette and over the Gháts, especially near the margins of rivulets and moist ground. Also all over India in the plains and on the Himálayan slopes up to 6,000 feet. Used as fodder for buffaloes and for thatching. Elephants feed on it while the grass is immature. In Ceylon it is very common in gardens and fences, and its long, white, silvery panicles and tall culms give it a very gaudy appearance. The leaves make good mats; used for various other purposes.

2. S. OFFICINARUM, Dalz. and Gibs. Suppl. 100.

Vern.—*Oos, Serdi, Ganderi.* Sugarcane is well known to every one.

There are several varieties of sugarcane which, whether for eating or for being used in the manufacture of sugar, are more or less largely cultivated throughout India. The reed, after the juice has been extracted, yields a strong fibre used in the manufacture of paper, for torches, and as a fuel in certain districts. The leaves are given as fodder. The fibres left after the juice is expressed are regularly used as fuel to boil the cane juice, other fuel being rarely used for this purpose. The following varieties of sugarcane

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are cultivated in the Bombay Presidency :—*Pundia* is thick, white soft cane, yielding a comparatively watery juice, but gradually driving all others out of the field wherever sufficient water is available for its cultivation, as it is vigorous and yields a good crop. I believe this is the Mauritius cane. *Striped cane or Bamunee.*—It is of less vigorous growth, but is somewhat richer in sugar than the former. Dark purple or " Kála ".—It is hard and gives rich juice ; is hardy in respect of living with less irrigation than the others, but it flowers every year, and this must lead to a loss of sugar. There is a fourth variety that grows to a great length and about the thickness of the thumb. It is grown in the Mával districts, and thrives with very little water. The most profitable of all is Pundia. For particulars about the cultivation, enemies and pest of sugarcane, see Watt's Dictionary of Economic Products and Mr. Ozanne's publications.

3. S. ARUNDINACEUM, Retz. Obs., Kunth Enum. Pl. 1. 475. S. CILIARE, Anders. S. EXALTATUM, Grah. Cat. Bomb. Pl. 239. S. MUNJA, Roxb. Fl. Ind. 246.

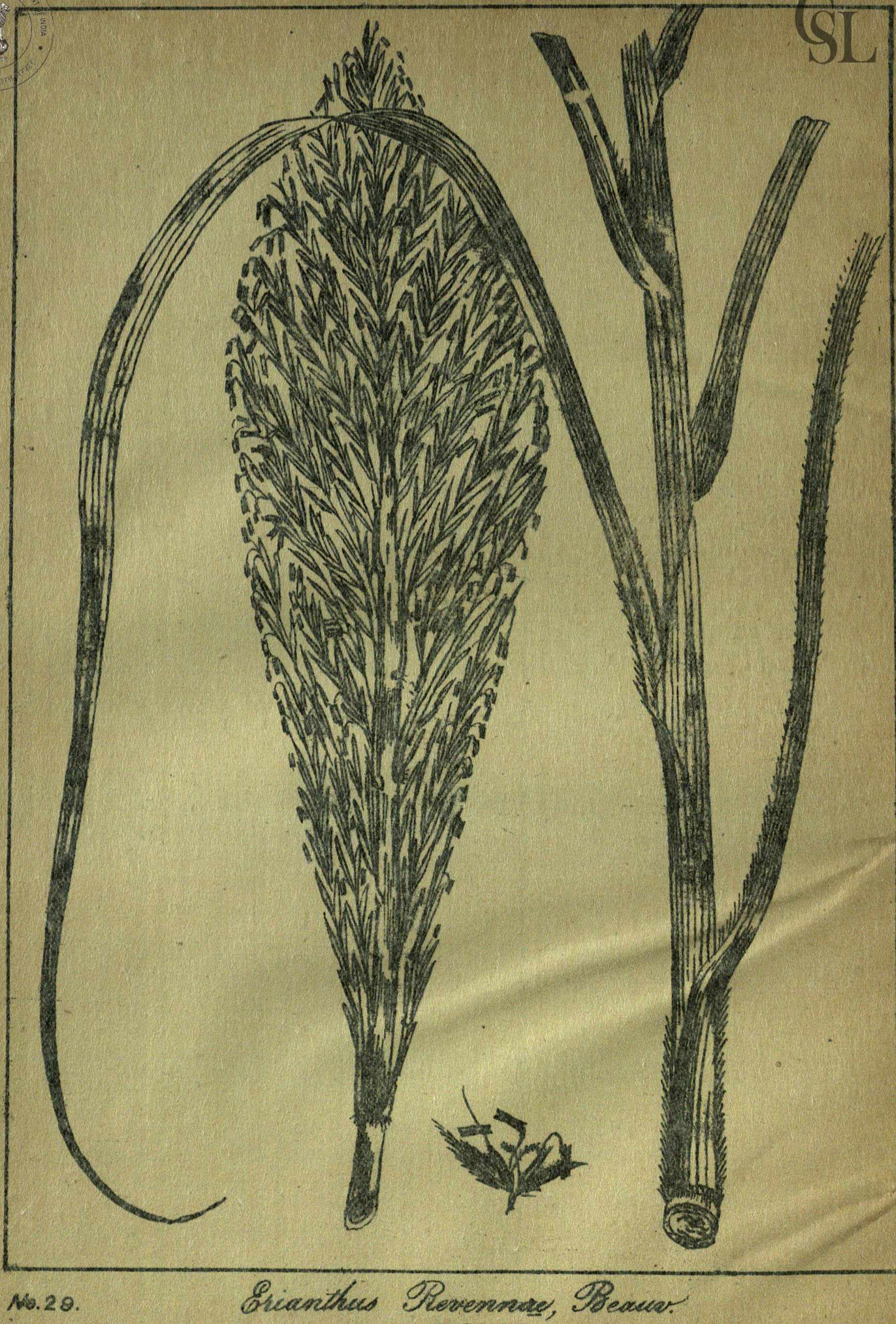
Vern.—*Munj*, *Sar*, *Kerpa*, Bomb. name.

Culm 10—20 ft., erect, glabrous. Leaves specially the upper long and narrow about 3—5 ft., tapering to a point, midrib white. Thistles hairy at the mouth. Panicle branched 1—2 ft. long, erect, clothed with white or occasionally purple hairs. Branches slender, spiciform, almost verticellate. Spikelets very small, greenish, violet or brownish. 1st glume nerveless ; 2nd glume acuminate. Callus with short silky hairs.

The Indian Mars according to the Purânas was born in a cover of this beautiful grass. Sir W. Jones. Grah. Cat. Bomb. Pl. 239.

Habit.—Seen in cultivation in Poona. It is of too coarse a nature to be used for fodder, except when quite young ; it is used, however, in districts where it grows spontaneously, for many other purposes, *e. g.* in the manufacture of matting, rope, paper, and for thatching ; the stems are made into screens, sieves and baskets ; the thicker portion of the stem is used for lining walls and in the construction of chairs and couches. In the Jhang district of the Punjáb, it is stated that in the cold weather the leaves are often the only pasturage for cattle. They (the leaves) are also chopped up and mixed with *bhusa*, grain, oilcake or green stuff. In the early spring the grass is set on fire and the cattle graze on the green shoots that quickly sprout again. (*Jhang Settlement Report*, p. 23 : *vide* Duthie.)

4. S. PROCERUM, Roxb. Flora Indica Carey Ed. Vol. I. page 243.



No. 29. *Erianthus Revennæ, Beauv.*

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Vern.—*Teng*, Bengallee; *Veda Ouse*, Maráthi.

Occurs in many gardens; it very rarely flowers on this side of India.

30. ERIANTHUS, Mich.

Racemes in a much branched panicle, the lateral sessile on the main elongated axis. It resembles SACCHARUM, but differs only by the awned spikelets. Tall narrow leaved grasses, with expanded panicles clothed with long silky hairs, as in the latter genus.

Species 17 in the warm countries of both hemispheres. E. RAVENNÆ extends as far north as Upper Italy.

1. E. RAVENNÆ, Beauv.; ANDROP RAVENNÆ, Linn.; RIPIDIUM RAVENNÆ, Trin. Fund. 169.

A tall grass. Culm 4—8 feet high, glabrous. Sheath scabrous, pilose at the mouth. Ligula short, pilose. Leaves narrow, long, acuminate, scabrous. Panicle ample, expanded, 1—2 feet, of a dirty light ferruginous colour as in some species of SACCHARUM. Glume acuminate, glabrous, but with long hairs arising from the callus. Awn straight or shortly bent, the exerted part as long as the spikelet.

Habit.—Said to grow towards the north of Gujarát. It is stated that it is put to the same uses as SACCHARUM SPONTANEUM.

31. ISCHŒMUM, Linn.

Spikelets in pairs, 1 sessile, 2-flowered; the lower flower male, the upper hermaphrodite; the other spikelet pedicellate, usually male, rudimentary or sometimes hermaphrodite. Rachis articulate. Lower glume of the sessile spikelet coriaceous, awnless, bicarnate; 2nd keeled, rarely awned; 3rd mutic with a male flower; 4th often bifid, awned.

About 24 species chiefly in India and Asia, very few in America and Africa. Racemes 2 or more, or one, in a few species.

1. I. ARISTATUM, Linn. Sp. Pl.

Vern.—*Bángadi, Kanden.*

Culm erect or decumbent, glabrous, 1—2 ft. or more. Nodes and sheaths glabrous or puberulous, the latter especially at the margins. Leaves glabrous or with a few hairs. Racemes 2—4, 2—2½ in. long; rachis glabrous or hairy. 1st glume of sessile spikelet irregularly winged towards the upper part, the wing white or purplish; 2nd glume chartaceous, prominently keeled, mucronate; 3rd with a male flower; 4th mucronate or with a

GSL

thin awn. The flower is often male. The lower glume of the pedicellate spikelet chartaceous, winged at the upper part, with 2—4 nodules at the lower part and 5—7 green nerves; 2nd glume keeled; 3rd with a male flower. The awn of the 4th twisted, thick, and purplish.

Habit.—Salsette, Deccan.

2. I. CONJUGATUM, D. 305.

Vern.—*Ber, Bher, Bar, Khanden, Bhangadi.*

Culm creeping 1—1½ ft., filiform, of purplish colour. Sheath glabrous. Ligula pilose. Lower leaves on a short (5—7 lin.) petiole; upper ones sessile, ovate, acuminate from a cordate base, hairy. Racemes conjugate, on a thick purple or whitish peduncle, joints hairy. Lower glume of the sessile spikelet coriaceous, villous below, with 2—3 nodules, ciliate at the margins above; 2nd glume pubescent; 3rd shorter with a male flower. Flowering glume divided down to the middle into 2 lobes, awned. Lower glume of the pedicellate spikelet 2—3-noduled below, 7—9-nerved; 3rd with a male flower; 4th unawned.

Mr. Davidson and others of the Survey Department informed me that it is a good fodder grass.

3. I. RUGOSUM, Roxb.

Vern.—*Laz, Bardi, Bar, Bher, Karkel, Tiki grass.*

Stem branching from the base. Leaves large acuminate, with scabrous margins. Racemes thick, 1—2 in. Lower glume of sessile spikelet coriaceous, convolute, winged above and marked with transverse (5—6) rugæ below, 5—7-nerved; 2nd glume 3-nerved; 3rd with a male flower; 4th bifid with a long twisted awn. Lower glume of the pedicellate spikelet with 2—4 transverse rugæ not prominent. Flowering glume with a thin awn.

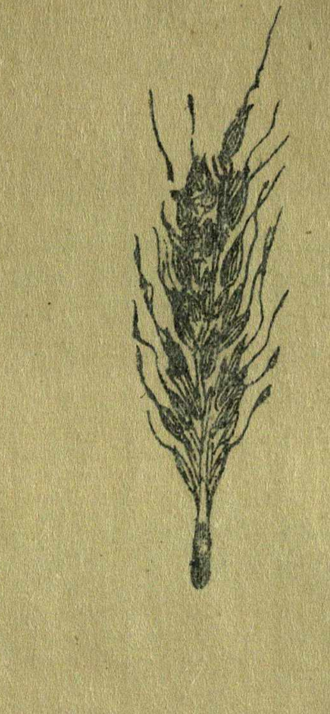
Habit.—Common all over India, Nepal, China, the Philippines and Timor. I am informed by Mr. Davidson that it grows with rice plants and injures them.

4. I. MOLLE, Hook. f.; I. ARISTATUM, var. INTERMEDIUM, Hack. MSS.

Tall, stout, branched, leaves sessile, spikes 1—2, stout, densely silkily villous with white hairs, joints broad half as long as the spikelets, 1st glume broadly ovate-oblong obtuse smooth dorsally villous all over many-nerved; 2nd obtuse silky keel narrowly winged from the middle upwards; 4th shorter cleft to the middle, lobes acuminate ciliate, awn geniculately inserted at the cleft.

5. I. DIPLOPOGON, Hook. fl. BHORKUS, Woodrow.

Annual, branching upwards, leaves lanceolate from a narrow base, upper sheaths spathiform, spikes 2 pale, peduncle flexuous,



NO. 30

Ischæmum rugosum, Roxb.

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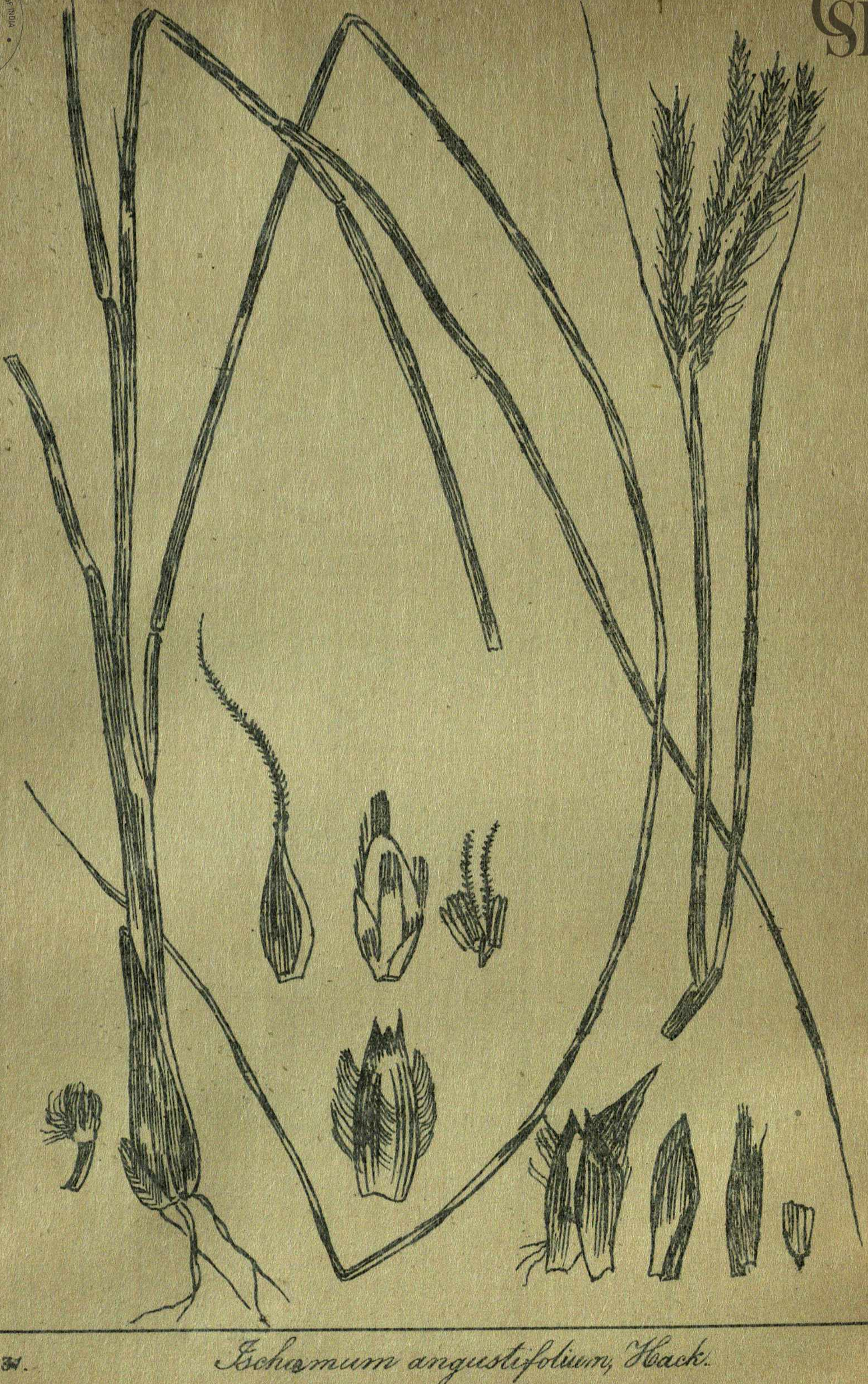
CSL



No. 31. *Ischæmum angustifolium, Hack.*

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GSL

joints dorsally ciliate, sessile spikelets $\frac{1}{6}$ — $\frac{1}{5}$ in., 1st glume oblong 2-cuspidate glabrous shining; 2nd awned 3-nerved lateral nerves pectinately ciliate with stiff hairs above the middle; 4th very short 2-fid lobes acute eciliate awned in the cleft.

6. I. ANGUSTIFOLIUM, Hack. *Sabie, Bhábar.*

Under cultivation at Poona it yields 24 cwts. per acre of dry grass from each cutting, and two cuttings yearly are obtained without irrigation. It is propagated by division of root and by seed, and thrives on coarse sandy (*moorum*) soil.—Woodrow.

Habit.—Seen in the garden of the Poona College of Science. It yields good material for cordage and for the manufacture of paper. It occurs near Rájkot.—Woodrow.

7. I. CONJUGATUM, Roxb. Fl. Ind. I. 321; Kunth. Enum. Pl. I. 513; Hack. Monogr. Androp. 205. Spodiofolius, Steud. Syn. Gram. 376.

Annual, prostrate below, leaves short base hastate or broadly deeply cordate, spikes 2 short villous, joints very short ciliate; 1st glume of sessile spikelet oblong obtuse flat 2-toothed villous even or lower margins obscurely nodose, 2nd lanceolate acuminate puberulous, 4th cleft to about the middle, awn dorsally inserted at or below the cleft.

8. I. PILOSUM, Dalz. and Gibs 305.

Vern.—*Koonda*, *Dungri-koonda* (Sátára name), *Pharari*.

Culm erect. Sheaths, nodes, and narrow short leaves glabrous. Spikes 3—6, almost all at the end of the culm; 2—4 in. long, clothed with long white hairs. 1st glume of the sessile spikelet, chartaceous, pilose, 4-nerved; 2nd a little longer, 5-nerved; 3rd shorter, 2-nerved with palea and male flower; 4th equal to the 3rd, bifid, awn thin. Pedicellate spikelet similar to the sessile, or reduced to a single glume.

Habit.—Throughout the E. and W. Khándesh, Bhúj, Poona, Sholápur and Sátára. Also in Mysore, Asirghar, Bellary and Chanda. A good fodder. Reported from Poona that it is a good fodder when young.

9. I. SEMISAGITTATUM, R. I. 321.

Vern.—*Dalaga*, *Ber*, *Saj-kadi* or *Kari*.

Culm decumbent, rooting from the lower nodes, the ascending part 1—1½ ft. Sheaths hairy, the hairs papilose at the base. Leaves lanceolate from a sagitate or cordate base, 1—1½ in. long. Spikes 2, 1½ in. long; angles of joints hairy. Lower glume of the sessile spikelet obliquely lanceolate, not winged above, 7-nerved, with 4—5 rugæ below; 2nd glume 1-nerved; 3rd glume a little shorter

CSL

1-nerved; 4th bifid, 3-nerved. Awn long, twisted. Lower glume of pedicellate spikelet coriaceous below and 2—3-noduled, keeled above, winged on one side, ciliate. 4th glume mutic.

Habit.—Seen specimens from Thána, Sátára and Kánara. Said to be good fodder.

10. I. IMPRESSUM, Hack. Monogr. 210.

Slender prostrate below, leaves ovate or oblong-lanceolate cordate lower narrower petioled, spikes 2 villous; 1st glume of sessile spikelets linear-oblong flat dorsally broadly irregularly depressed with shallow sub-semilunar pits in the lower $\frac{2}{3}$ above it winged and 2-cuspidate; 2nd dorsally rounded with a median gibbosity and an auricle-like wing above it; 4th cleft to above the middle, awn short geniculately inserted at the cleft.

11. I. LISBOÆ, Hook. Fl.

Stem creeping below, leaves oblong acute and open sheaths villously tomentose. Spikes 2, softly tomentose; 1st glume of sessile spikelets oblong, 2-fid, convex keels with broad auricular ciliate wings; 2nd glume coriaceous, scabridly awned, keel winged above the middle; 4th glume oblong, obtusely 2-lobed, awn slender inserted between the rounded lobes.

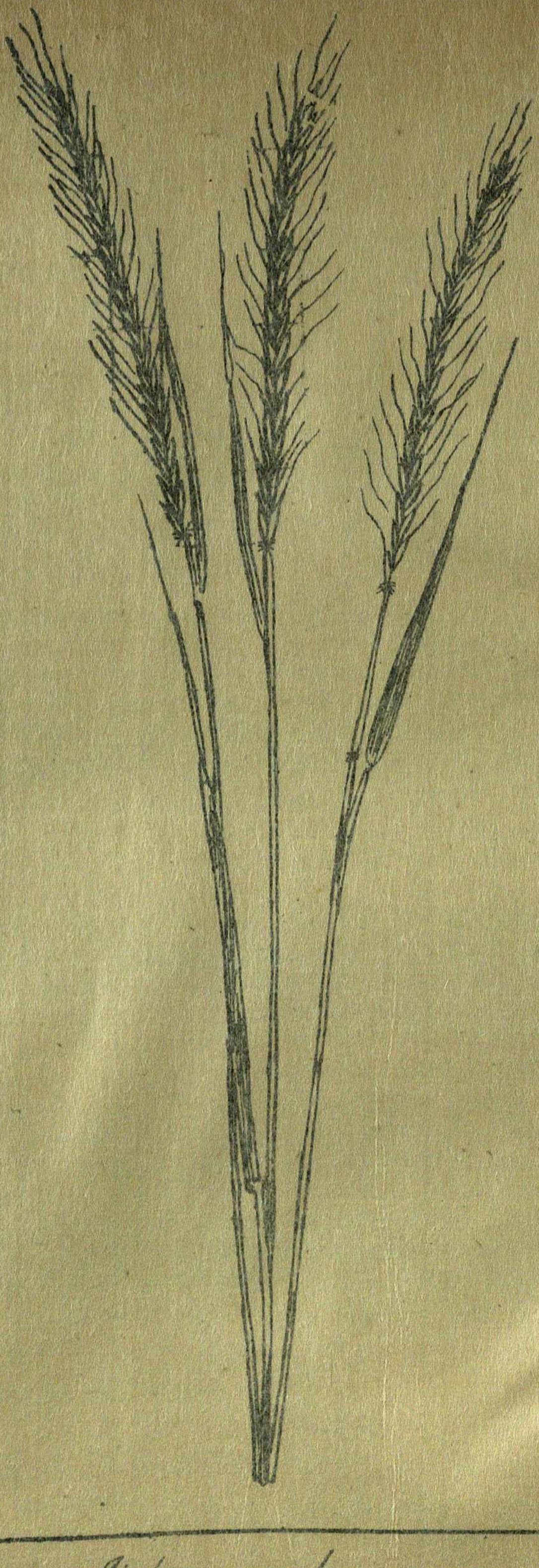
Stem very stout, rooting at the thickened nodes; branches ascending 8—14 in., glabrous. Leaves on the creeping stem 1—2 in., closely imbricating in two series, the blades reflexed at right angles to the erect short open sheaths, softly tomentose on both surfaces; lower sheaths $\frac{1}{2}$—1 in., villous; ligule short bearded with very long hairs. Spikes 2 in., joints and pedicels about half as long as the spikelets, stout, concavo-convex, shortly villous, truncate. Sessile spikelets $\frac{1}{8}$ in., callus very large, glabrous; 1st glume thickly cariaceous, dorsally convex, ciliate above the middle, margins broadly incurved below the middle; 2nd glume rather longer, rigid, dorsally rounded below the wing; 3rd glume ovate-oblong, obtuse, margins ciliate, paleate, male; palea chartaceous, obovate, 2-nerved, nerves meeting at the tip with very broad hyaline wings, above the middle; 4th glume $\frac{2}{3}$ of the second, 3-nerved below the middle, awn about twice as long as the spikelet; palea lanceolate, nerves ciliate. Pedicelled spikelets laterally compressed; 1st glume convex, broadly winged, villous; 4th glume shortly awned or awnless.—The habit of the only good specimen I have seen is very peculiar.

Habit.—North Kánara, Lisboa.

12. I. CILIARE, Retz. Obs. VI. 36.

Vern.—*Bara, Bar.*

CSL



No. 32

Ischæmum laxum, R. Br.

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CSL

Culm 1—2½ ft. Leaves linear-lanceolate, acuminate with scattered tubercle-based hairs, margin scabrous. Spikes 2, rarely 3 at the end of the thickish peduncle. Spikelet sessile. Lower glume coriaceous below; convex, glabrous, scabrous above; 5—7-nerved, hairy with ragged edges; 2nd glume 3-nerved, acuminate or pointed; 4th ciliolate. Awn twisted. Lower glume of the pedicellate spikelet surrounded with a tuft of hairs at its origin.

Habit.—Several varieties are described; all or almost all exist in India and Ceylon.

13. I. Timorense, Kunth. Revis. Gram I. 369.

A slender grass. Culm 8—20 in. long, somewhat compressed, creeping and rooting from the lower nodes, branching from the middle ones; the upper part reduced to a naked peduncle. Nodes short-bearded. Sheath glabrous, ciliate at the mouth. Ligula short, truncate. Leaves very narrow at the base, linear-lanceolate, 3—4 in. long, acuminate, scabrous at the margins and sprinkled with adpressed hairs. Racemes 1—1¼ in. long, 2 in number, 1 sessile, and the other on a short (about 3 lines long) pedicel, yellowish. Rachis and pedicels of spikelets with yellowish hairs. 1st glume of the sessile spikelet 3—5-nerved, hairy at the base, glabrous on the dorsum; 2nd bidentate, one of the teeth drawn into a slender awn-like point; 3rd glume hyaline, thin, with a male flower (anthers and palea) in the axil; 4th hyaline divided into 2 lobes, sending a slender bent and twisted awn about 4—5 times longer than the spikelet. A hermaphrodite flower in the axil. 1st and 2nd glumes of the pedicellate spikelet with a short straight awn. The remaining glumes as in the sessile spikelet.

Habit.—Received specimens from N. Kánara. It grows also in Ceylon, Pegu, Martaban and Singapore, Java and Timor. Nothing is known of its uses.

14. I. laxum, R. Br.

Vern.—*Suckal, Sheda, Pavna, Pal* (arrow).

Culm erect, 2—3 ft. scabrous or pubescent. Leaves linear, long-acuminate, gradually ending in a scabrous or glabrous point. Spike single, erect or somewhat falcate, 2—4, or rarely 5 in. Rachis and pedicels white-ciliate. Lower glume of sessile spikelet 3-nerved, marked with a depression and sulcate in the middle; 2nd produced into a long straight awn; 3rd with a palea and a male flower; 4th with a palea hermaphrodite flower with a long bent awn. Lower glume of the pedicellate spikelet 5-nerved, ciliate at the margins. 3rd and 4th glumes with male flowers or none, unawned.

Habit.—All over the Presidency, in Ceylon, Australia, Abyssinia, Arabia and Cape Verde. Said to be good fodder. Often used for thatching in W. Khándesh.

CSL

15. I. SULCATUM, Hack.

Vern.—*Sheda, Pavna.*

Closely allied to the last and known to natives by the same name; perhaps a variety; but the sessile spikelets are all awned. 1st glume bicuspidate and the 2nd awned.

Habit.—Specimens received from Sátara and Sholápur (Málsiras, Sholápur táluka).

16. I. SPATHIFLORUM, Hook. f. TRACHYPOGON FASCICULATUS, *Munro MSS.*

Tall, stout, much branched above, spikes enclosed in long narrow spathes very slender, joints and pedicels long, sessile spikelets $\frac{1}{3}$ in. narrowly linear-lanceolate; 1st glume of sessile spikelet dorsally deeply channelled densely silkily villous to above the middle, keels rounded scabrid above; 2nd truncate and mucronulate; 4th linear-oblong, awn slender inserted between 2 subulate teeth.

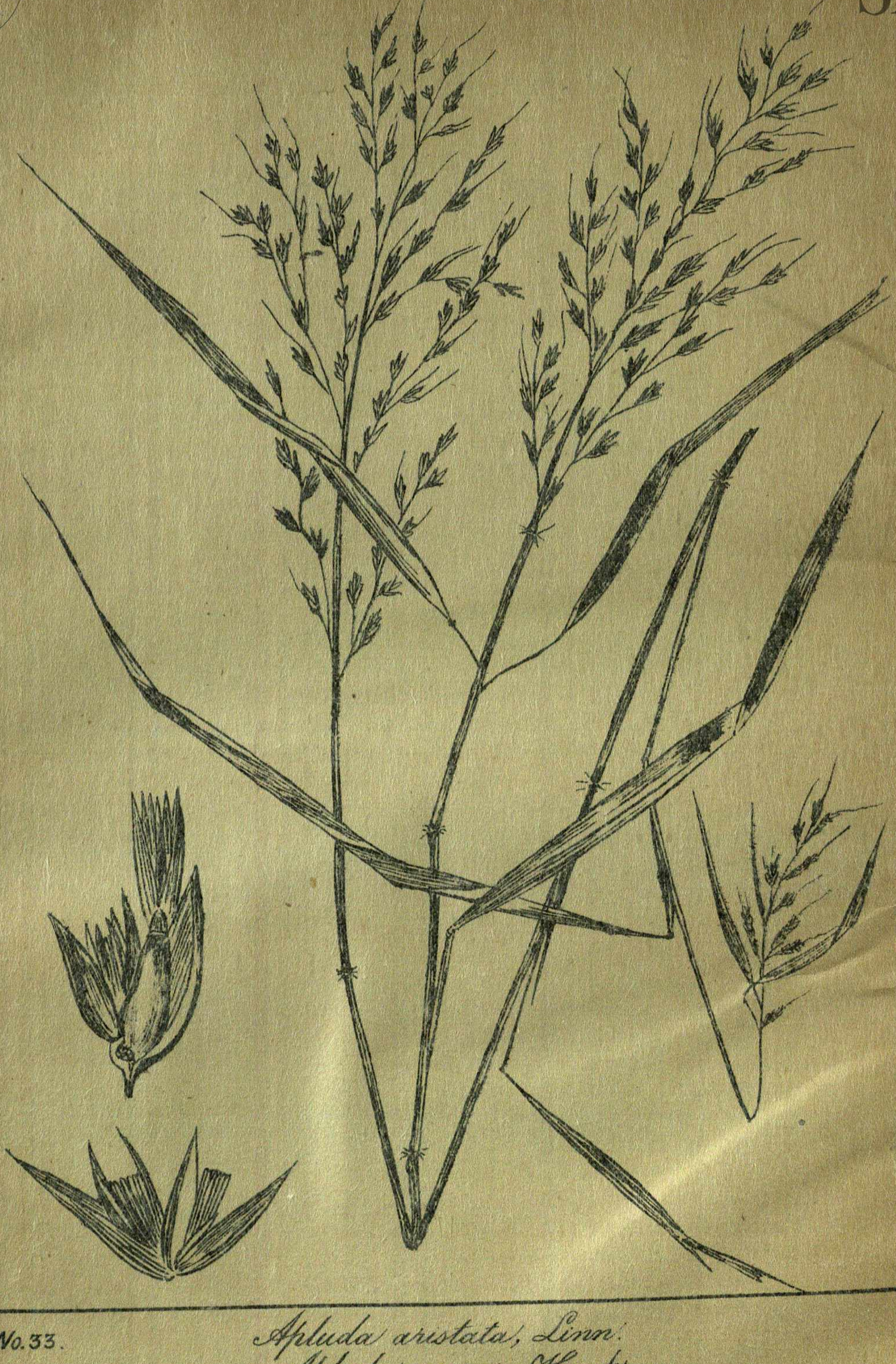
17. I. RAMOSISSIMUM, Hack. Monogr. Androp. 249.

Stem erect, excessively paniculately branched, spikes short in leafy panicles glabrescent; 1st glume of sessile spikelet linear-oblong very obtuse, emarginate, 8—10-nerved, deeply channelled between the median nerves, margins involute, not keeled, aculeolately ciliate above; 2nd obtuse, mucronulate, 5-nerved, keel scabrid above with a pencil of hairs; 3rd linear obtuse 3-nerved ciliate paleate; 4th like the 2nd narrowly linear 1-nerved glabrous narrowed into a stout awn.

18. I. NUTANS, Lisboa.

Vern.—*Diedia, Beyla, Bal-Gavut, Kadbrieber Bhas* (also the name of APLUDA ARISTATA), *Barchi Canther.*

Culm erect, round, very stout, glabrous, 3—4 ft., deeply grooved on the side of the leaves, very ramous from the base. Sheaths keeled, loose shorter than the inter-nodes. Ligula $\frac{1}{2}$—1 line long, truncate of yellowish brown colour. Nodes tumid, glabrous. Leaves narrow at the base, acuminate, thin, almost membranous, glabrous, or scabrous, 1—1$\frac{1}{2}$ ft. by 10 lines in the middle, the uppermost almost reduced to a short point or to the sheath midrib large and prominent on the lower surface, sparsely hairy; the upper surface scabrous with many long hairs proceeding from a tubercled base. Panicle leafy, erect or nodding, many jointed (7 nodes or more) giving out from each joint 3—5 fasciculate branches. Each branch 2$\frac{1}{2}$—4 in. long, surrounded at its origin by an acute white bract, and terminating in a single raceme supported by a long, articulate, slender, closely sheathed, slightly falcate peduncle.



No. 33. *Apluda aristata, Linn.*

Apluda varia, Hack.

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GSL

Racemes 1½—2 in.; peduncles 3—4 in. The rachis, sessile spikelet, pedicel of the pedicellate spikelet white, hairy; the pedicellate spikelet with a few hairs. Lower glume of sessile spikelet broad, chartaceous, obtuse, white hairy; 2nd glume as long as the lower, but thinner and broader, both acute and ciliolate at the margins; 3rd smaller, hyaline with a small, not well-developed male flower; the 4th still smaller with a twisted and bent awn, 14 lines long from the lower part of the dorsum and a hermaphrodite flower; stamens twice the size of those in the axil of the 3rd glume. 1st glume of the pedicellate spikelet stiff, purplish, acuminate or produced into a short straight awn, marked at its origin with a deep purple-coloured spot; 3rd glume thin, with an undeveloped flower, or none; the 4th with a male flower well formed, unawned. The lower part of racemes bears 2—3 pedicellate spikelets and no sessile spikelet.

It is nearer I. RAMOSISSIMUM of Hackel.

Habit.—Very common at Lanowli, Khandála and over the Gháts down to the foot.

19. I. PETIOLARE, Hack. Trin. in Mem. Ac. Petersh.

Vern.—*Koonda, Nanjdi, Rhalphil, Philphil, Kallil, Pharavi* (the latter name also given to I. PILOSUM).

Culm 4—5 ft., smooth, glabrous. Sheaths and nodes pubescent. Leaves gradually ending in a short petiole, green, smooth, 8—9 in. by 4—5 in.; clothed with hairs, papilose at the base. Racemes terminal, fascicled, and branched, 4—5 in., hairy in the axil.

32. APLUDA, Linn.

Panicle leafy composed of numerous bracteated clusters, each of which consists of 1 fertile spikelet and 1 male floret below it sessile between 2 broad flattened pedicels, one bearing a rudimentary or barren spikelet and one occasionally a perfected spikelet or a male. Terminal glume is generally awned.

1. A. VARIA. Hack; A. ARISTATA, Linn.

Vern.—*Phulse, Tulsi, Pcodi, Khavas, Bhickma, Kharwel, Tambiti, Tambat, Chickwar, Kurdia, Pokilia, Pockli, Phulaer, Bhas, Makkha.*

Culm slender, creeping or scandent, rooting at the base, often of a purplish colour. Branches erect, 2—4 ft. or more. Leaves 2—6 in. by 1—3 lines, sometimes attenuated into a short petiole. Panicle long, leafy; bracts ovate or boat-shaped, pointed. The rest as in the genus.

GSL

The leaves of A. ROSTRATA are petioled, the petiole of A. COMMUNIS is short. This grass in hedges and amongst bushes becomes elongated and assumes a climbing habit. Reported from some districts to be a good fodder. It is eaten by cattle only when young and green. Poona report says: "Good fodder for buffaloes when young, but it breaks down easily when tall: hence not fit for cutting and stacking."

Habit.—Several varieties are described as species, such as A. MICROSTACHYA, A. COMMUNIS, A. VILLOSA, A. ROSTRATA. All these grow in India, and the above vernacular names are applicable to all of them.

33. ROTTBŒLLIA, Linn. fl.

Spikelets in pairs, sessile and embedded alternately in the cavity of the notches with 1 fertile flower, and sometimes a male below it; the other on a closely appressed pedicel with a male or rarely hermaphrodite flower, or reduced to 1 or 2 empty glumes; always smaller. All glumes awnless.

Species about 18, in the tropics of both hemispheres, or 25. including HEMARTHRIA, CŒLEORACHIS, PELTOPHORUS.

1. R. COMPRESSA, Linn. Suppl. 114; R. GLABRA, Roxb. Fl. Ind. I. 353; HEMARTHRIA COMPRESSA, Grah. Cat. Bomb. Pl. 233; Duthie Grass. N. W. Prov. 18; Todd. Gr. N. Ind. 30.

Culms creeping and rooting below, then erect and scandent, 5—20 feet long (Roxb.), more or less compressed and sparsely branched. Leaves narrow; sheaths hairy at the mouth. Spikes slender, solitary, or 2—3 together, 2—2½ in. long. Spikelets small about ⅙ in. 1st glume broad, ovate, lanceolate, obtuse, not constricted below the tip.

Habit.—Throughout India in wet places, borders of tanks, &c.

2. R. ACUMINATA, Benth.; Hackel ANDROPOG.

A small cespitose grass. Culm very slender, usually geniculate at the lower nodes, 4—6 in. high, glabrous. Nodes usually 3, glabrous. Ligula a line. Sheaths loose, shorter than the internodes. Leaves 2½—4 in. long and 3 in. broad, acuminate, finely striated. Racemes simple, straight, solitary, 1—2 in. long, brittle, terminal, elevated, each on its own filiform, jointed, sheathed peduncle 1½—3 in. long, arising from the axils of the leaves. Spikelets about 1½ in. long. Sessile spikelet:—Outer glume coriaceous, marked at the base by 4 hard transverse ridges, and surmounted at the upper end with a thin transparent wing produced into a small straight awn-like process, 2 lines long; 2nd glume unawned; free from ridges not awned, thin, transparent, many nerved;

CSL

3rd glume smaller than the 2nd with a palea and 3 small stamens; 4th glume smaller than the 3rd; with a still shorter palea with 3 stamens and 2 styles in its axil. *Pedicellate spikelet*:—1st glume with many nerves, not muricated, but with small wings on each side; 2nd glume nearly as long as the first, but thinner; 3rd glume smaller than the 2nd, transparent, hyaline, with a male flower and palea; 4th glume of the same size as the 3rd with a palea and minute stamens. Pistil not seen.

Habit.—Collected at Kárwár by Mr. Talbot. Also at Mysore and Karnatak.

3. R. DIVERGENS, Hack.

Vern.—*Marvel* (Mahábaleshvar name).

Cespitose. Culm 6—9 in., branching from the base, glabrous. Nodes 2—3 hairy. Sheath 1—$1\frac{1}{2}$ in., loose, keeled. They and the leaves with numerous hairs form a minutely papilose base. Leaves 3—$4\frac{1}{2}$ in. by $2\frac{1}{2}$ lines. Racemes of pale yellow colour, generally falcate, simple, solitary, rather thick, each elevated on its filiform, jointed, sheathed peduncle of various lengths. Lower glume of the sessile spikelet coriaceous, elegantly muricated at the lower half with the crooked points turned upwards; the upper surrounded on each side by a thin, white, membranous wing with an awn 3 lines long, arising from the inner margin of each wing; straight but slightly diverging from the awn of opposite side. 3rd glume acute, thin, not muricated. 4th glume with a seed. As the grass was in seed, no stamens or pistil were found. 1st glume of pedicellate spikelet chartaceous with several (7) nerves, not muricated, with transparent, triangular wing as in the 1st glume of sessile spikelet, on one side only; 2nd glume thinner, boat-shaped with transparent wing on the upper part of the keel, terminated by a short awn. No other glumes nor stamens nor pistils seen.

Habit.—At Mahábaleshvar and in the Konkan and Deccan.

The last two grasses are new species.

4. R. TALBOTI, Hook. f. (non-Lisboa).

Annual, leaves linear, spikes solitary, 1st glume of sessile spikelet lanceolate, narrowed into a slender scabrid awn, and with 3 transverse ciliolate ridges towards the base broadly winged above it, pedicel of upper spikelet adnate to the joint of the rachis.

Stems 6—8 in., slender, erect or base geniculate, subsimple. Leaves 2—3 in., narrow, smooth; sheath glabrous; ligule short, membranous. Peduncles 2—3 in., very slender, flexuous. Spikes $\frac{1}{6}$ in. diameter, green, joints very short, tumid excavate opposite the spikelet, top broad, cavity very large, margins thick hispidulous. Spikelets closely imbricating, ½ inch long, including the awn; callus annular, ciliolate; 1st glume of sessile spikelet many-nerved on the coriaceous disk; 2nd much shorter, hyaline, ovate-oblong, acute, 1-nerved; 3rd broadly oblong, tip rounded, faintly 3-nerved, male; 4th small, oblong, obtuse, nerveless, palea as long, nerveless. Pedicelled spikelets as long as the sessile; 1st glume very unequally winged, dorsally smooth, awn as in the sessile; pedicel wholly adnate to the joint of the rachis.

Habit.—Goa district.—Talbot.

5. R. CLARKEI, Hack.; R. GIBBOSA, Hack.

Culm erect, 2 ft. or more. Sheaths striated, smooth or slightly hispid with a few hairs. Nodes with a ring of hairs. Leaves 5—6 in. long, 5 lines broad in the middle, ending gradually into the sheath, studded with hairs, tubercled at the base; middle rib white, prominent. Panicle terminal, branched; a bract at the base of each branch. Spikes of a pale yellow colour, friable, glabrous, ½—1 in., solitary on each peduncle; peduncles 1—2 in each axil with a closely sheathing bract at the base of each. 1st glume rather gibbous at the lower part and there hairy, the edges slightly turned in at the upper part; 2nd glume smaller, chartaceous, indistinctly 3-nerved; 3rd smaller than the 2nd; no flower in the axil; 4th smaller than the 3rd, palea not seen. In some spikelets only seeds were observed. Pedicellate spikelet consists of a solitary spathulate glume with the upper end bent inward.

In September of last year (1890) Mr. Talbot of Kánara sent me specimens of this grass marked " New species of Manisuris." Finding, however, that it was a species of Rottbœllia, hitherto undescribed, I wrote down in my note-book the description above given, naming it R Talboti after Mr. Talbot. In February last (1891) Duthie wrote to me saying that in the collection of grasses sent by Mr. Talbot to Polten, Hungary, Mr. Hackel had identified one as a new species of Rottbœllia and named it R. gibbosa, and in May last, at my request, kindly forwarded me a specimen which turned out to be the one I have described above. I think the name of R. Talboti ought to have the honour of priority if Professor Hackel has not yet published his description. Sir J. Hooker describes this grass (in Hook. Fl. Br. Ind.) under the name of R. Clarkei in Æstra. Bot. Leitsch XLI. (1891) 8, giving as synonyms *R. gibbosa*, Hack. ex Lisboa in Bomb. Journ. Nat. Hist. Soc. VI (1891) 185; R. Talboti, Lisboa MSS. l. c.

6. R. EXALTATA, Linn. Roxb. Cor. Pt. t. 157.

Vern.—*Barsali, Bura, Sooato, Konda Canookoo.*

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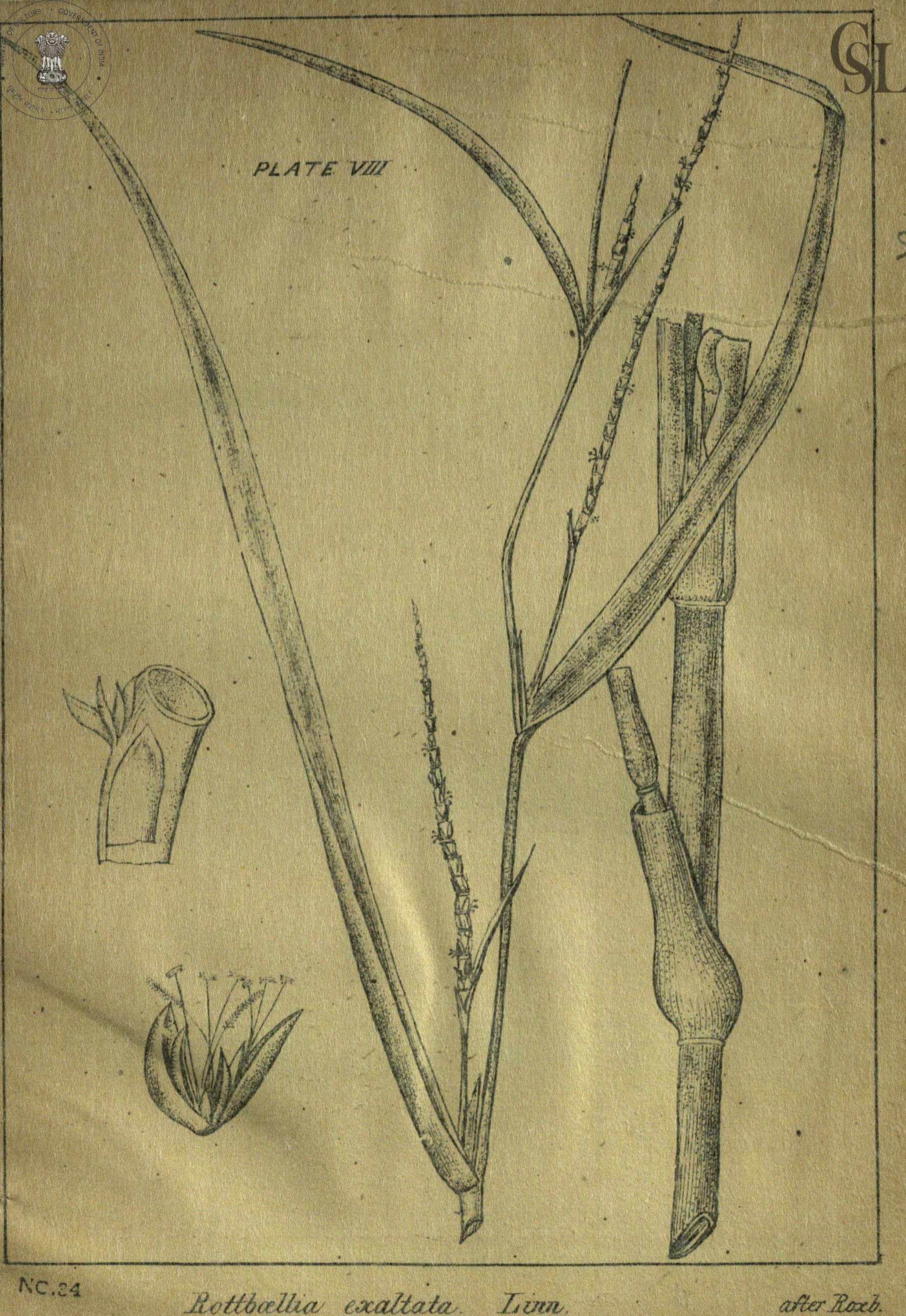
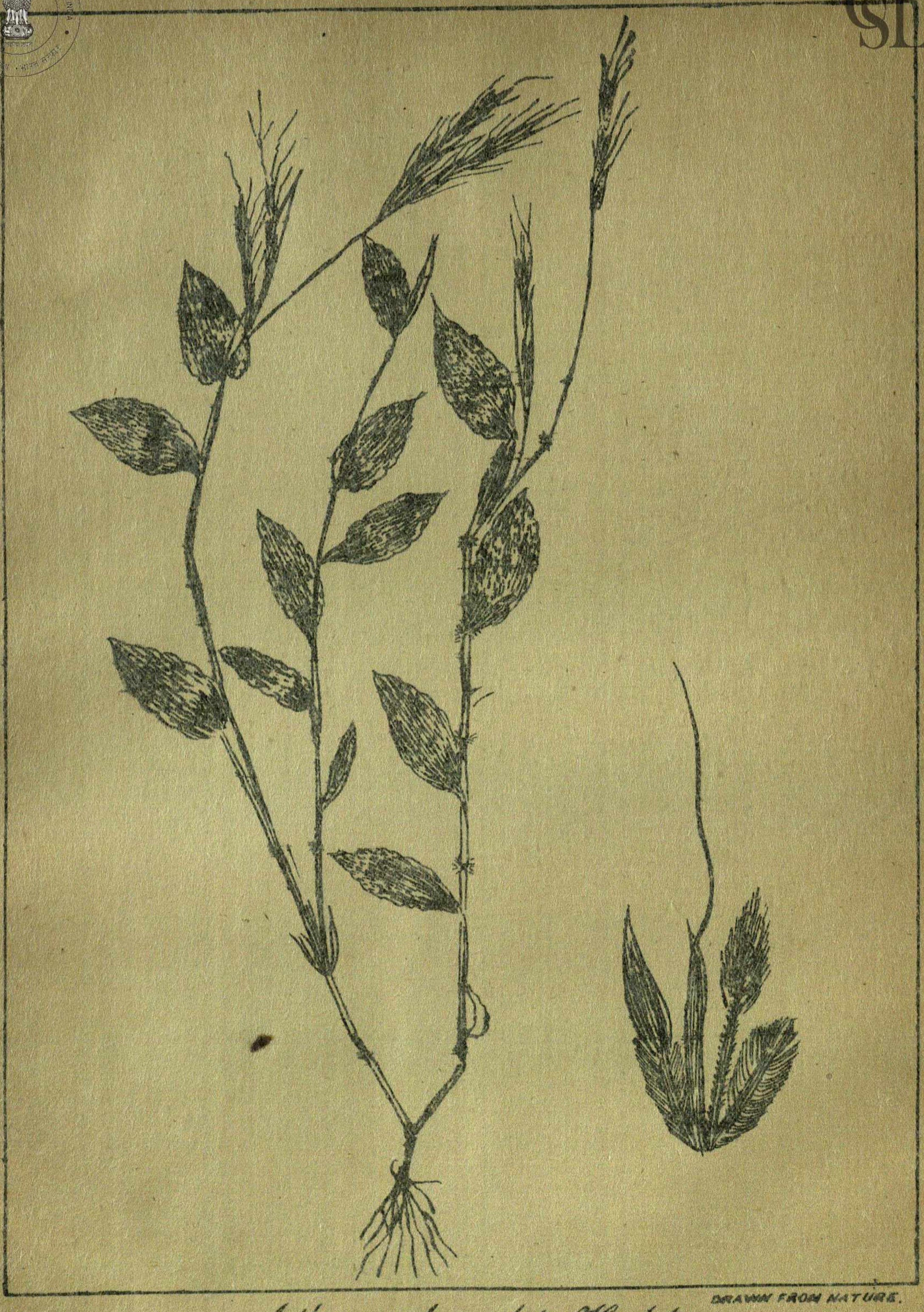
PLATE VIII



NC.24 *Rottbœllia exaltata. Linn.* *after Roxb.*

CSL



DRAWN FROM NATURE.

No. 35. *Arthraxon lanceolatus, Hockst.*

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CSL

Stout erect, 6—10 feet. Sheaths hispid. Leaves hispid at the margins. Lower glume of the fertile spikelet coriaceous, smooth, many-nerved; 3rd with a male, the 4th with a hermaphrodite flower. Pedicellate spikelet much flatter with 2 male flowers, or only a palea in the 3rd glume.

Habit.—Throughout India, Ceylon, Burma, China, the Philippines and Africa. Seen specimens from Yellapur, N. Kánara.

34. POGONATHERUM, Beauv.

Is a beautiful ornamental grass. Spikelets very small, the 2nd empty glume and the flowering glume with long delicate awns. Anthers two.

1. P. SACCHAROIDEUM, Beauv.

Slender, branched, much tufted grass, 6 in.—1½ ft. high. Branches slender, bearing simple spikes. Spikelets surrounded by hairs. The 2nd and the flowering glumes with twisted awns Hairs and awns are of a golden colour.

Habit.—Common on the Himálayás, in Sind, and on rocky hills in other parts of India, Ceylon and as far as China. In gardens in Bombay and Baroda.

2. P. RUFIBARBATUM, described by some authors, is a variety.

35. ARTHRAXON, [a] Beauv.

Delicate grasses. Racemes or spikes slender usually digitate as in DIMERIA, but there are 3 stamens and the lower glume broad not truncate as in LOPHOPOGON; 1 spikelet of each pair sometimes reduced to a pedicel, or altogether absent; rarely male or neuter. Flowering glume awned from the point or from the base, but the awn twisted and bent; rarely awnless. Palea very small and hyaline.

Habit.—Species about 10 in the tropics of the old world; one extends to Japan, China, and Asia Minor.

1. A. LANCEOLATUS, Hockst. in Fl.

Culm 1½—2 ft. or more. Leaves lanceolate from cordate base. Spikes 2—5, terminal. Lower glumes of the sessile spikelet chartaceous, acute; keel muricate, the margins often serrulate; 4th glume awned, 1st glume of the pedicellate spikelet not awned.

2. A. ECHINATUS, Hockst. in Fl., a variety of the last.

Vern.—*Kadu-marvel, Marvel.*

The murication on the external surface of the lower glume of the hermaphrodite spikelet varies in different specimens.

Habit.—Very common on the Gháts, and all over India, Nepal and China. Said to be "good cutting and grazing specially when young." Not eaten by horses.

3. A. INERMIS, Hook. f.

Culm slender. Leaves 1—2 in., ovate, amplexicaul, caudate acuminate with long hair on the lower surface. Spikes short, green. Spikelets all sessile; 1st glume strongly 7—9-nerved; 2nd as long as the 1st, obtuse emarginate; 3rd none. Awn of the 4th basal. Anthers very large. Pedicellate spikelet none.

Habit.—Konkan, Panchgani.—Woodrow.

4. A. CILIARIS, Beauv. Agrost. t. 2, fig. 6 (not good).

Vern.—*Turade, Turde.*

Culm 1—1½ ft., decumbent or creeping at the base. Sheaths ciliate at the margins. Leaves acute or acuminate. Lower glumes chartaceous, distinctly 2—10-nerved; nerves very scabrous. 4th glume usually awned. Pedicel of the sterile spikelet is variable, sometimes wanting.

Habit.—In Lanowli and Sátára. Eaten by cattle.

5. A. MICROPHYLLUS, Hockst.; A. LANCIFOLIUS, A. MOLLIS.

The last two are varieties of the 1st. In the last 2, sessile spikelet solitary, specially on the upper part of the spikes. Their vernacular name is *Faradyache gavat.*

Habit.—They are common during the rainy season in Bombay, Lanowli, Western Gháts, in Poona and Násik. Often seen growing on the top of old walls. Good fodder for cattle.

6. A. QUARTIANUS, A. Rich.

Culms rather tall. Nodes ciliate. Leaves with hairs bulbous at the base, acuminate-cuspidate. Pedicellate flowers sometimes wanting; when present, glabrous, or with short hairs.

7. A. MICANS, Hockst. in Fl.

Described by Hockst as a variety of A. CUSPIDATUS. Pedicellate spikelet absent, or when present, with 1 empty glume alone.

36. THELEPOGON, Roth.

Sessile spikelet bi-flowered, 1 hermaphrodite above, with a male below, awned. Lower glume coriaceous, margins incurved, dorsum marked with transverse prominent rugæ, sometimes verrucose; 2nd glume chartaceous, acuminate, mucronate with short transverse rugæ, margins inflexed; 3rd hyaline mutic with a palea and a male flower; 4th with a long twisted awn bearing a palea and a perfect flower. The pedicellate flower reduced to simple pedicel.

Species one, with affinity to ISCHŒMUM and ROTTBŒLLIA.

1. T. ELEGANS, Roth.; ANDROPOGON PRINCIPES, Rich. Tent. Fl. Abyss. 102.

Vern.—*Tirpha*, *Kadi*.

A beautiful grass 2—3½ ft. Its spikelets resemble those of ISCHŒMUM RUGOSUM.

Habit.—Common in Poona, Násik, and in other parts of this Presidency, Malabár and Africa. Often grows on the sides of the roads and boundaries of cultivated fields.

37. LOPHOPOGON, Hack.

(Translated from Hackel's Andropogoneæ.)

Racemes two or digitate. Spikelets at each node of the rachis, 2, one shortly pedicelled or almost sessile, 1—2-flowered, upper or terminal flower, female. The lower, when present, male; the 4th glume awned. The sessile also bi-flowered, both flowers male, 4th glume muticle. 1st glume of both spikelets tridentate, mutic, clasping the other glumes; 2nd glume mutic or awned; 3rd glume narrow, hyaline, empty or bearing a diandrous male flower; 4th glume thin, hyaline. In pedicelled spikelets the awn is well developed with or without palea. Stamens 2. Styles very short, but the stigma elongated.

Species two, one in India and the other in Australia.

1. L. TRIDENTATUS, Hack.; ANDROPOGON TRIDENTATUS, Roxb. Fl. Ind.

Cespitose. Culm slender, 5—12 in. high, glabrous, unbranched. Sheaths glabrous, shorter than the internodes, the uppermost ventricose with a rudiment of the leaf. Ligula very small, truncate, hyaline. Blade linear, acuminate, 1½—2½ in. long, conduplicate when young, flat when old; margins fimbriate at the base. Racemes 2, closely aggregated, about ¾ in. long, inserted on a short slender peduncle arising from the axil of the upper leaf. Spikelets densely imbricate. Sessile spikelets cover the pedicellate ones, obovate oblong. 1st glume chartaceous, cuneate, truncate and tridentate at the apex, sparsely ferrugino-ciliate at the lower part of the margins, glabrous on the dorsum; 5-ribbed. 2nd glume a little longer than the 1st, membranaceous, lanceolate, acute, 3-ribbed, ferrugino-hirsute at the upper part with a straight awn arising from between the teeth; 3rd glume equal to the 1st, narrow-linear, acute, hyaline, glabrous, not nerved. Palea none. Anthers of the lower flower undeveloped or sterile. 4th glume equal to the 3rd, lanceolate acute, entire or bidentate

CSL

mutic, hyaline, glabrous; palea of the upper flower sometimes absent. Pedicels of the pedicellate (female) spikelets short but covered with yellowish-brown or ferrugineous hairs. 1st glume membranaceous, 3-dentate ciliate, at the lower part of the margin, with long brown or ferrugineous hairs; dorsum with a bundle of ferrugineous hairs about the middle, 5-nerved. 2nd glume rather longer than the 1st, membranaceous, broadly lanceolate, acute, with a straight awn between the teeth, 5-nerved, ferrugino-pilose on the nerves and margins. 3rd glume as long as the 1st, as in sessile spikelet, or obsoletely bidenticulate; palea none. 4th nearly as long as the 2nd, hyaline, narrow-linear oblong, acute or bidenticulate, dilated at the top and giving out a strong awn; palea as long as the glumes, obtuse. Stamens of the upper flower none.

Uses not known.

Habit.—Common in Poona, Sholápur, Konkan, Coromandel, Malabár.

38. MANISURIS, Swart.

Spikelets 2 at each cavity of the rachis, 1-flowered. Lower glume of the outer or lower spikelet coriaceous, globular, concave and rugose; 4th with a fertile flower, all mutic. The other spikelet sessile, with a male flower, or this is absent.

Habit.—Species one in all tropical and sub-tropical regions.

1. M. GRANULARIS, Swart.; Roxb. Cor. Pl. t. 118.

Vern.—*Kangri, Datura Ghás.*

An erect hairy grass easily recognised by the globular foveolate and verrucose surface of the lower glume of the fertile spikelet.

Habit.—All over India, the Himálayas and Nilghiris, China, Brazil and Peru. Mr. Coldstream says that it is both grazed and stacked at Hissur, Punjáb, but not much relished by cattle. At Ajmere considered to be good fodder grass.

39. OPHIURUS, R. Br.

Spikelets solitary or sometimes 2 in the lower part of the spike, sessile and embedded in the alternate cavities of the rachis of a spike with 1 hermaphrodite or female flower, and often a male one below. The lower empty glume hard, covering the cavity of the rachis. Flowering glume transparent, all mutic. Occasionally there is a rudimentary pedicellate flower.

Species about 4. Resemble much ROTTBŒLLIA from which they are distinguished by the absence of the 2nd sterile spikelet, at least at the upper portion of the spike.

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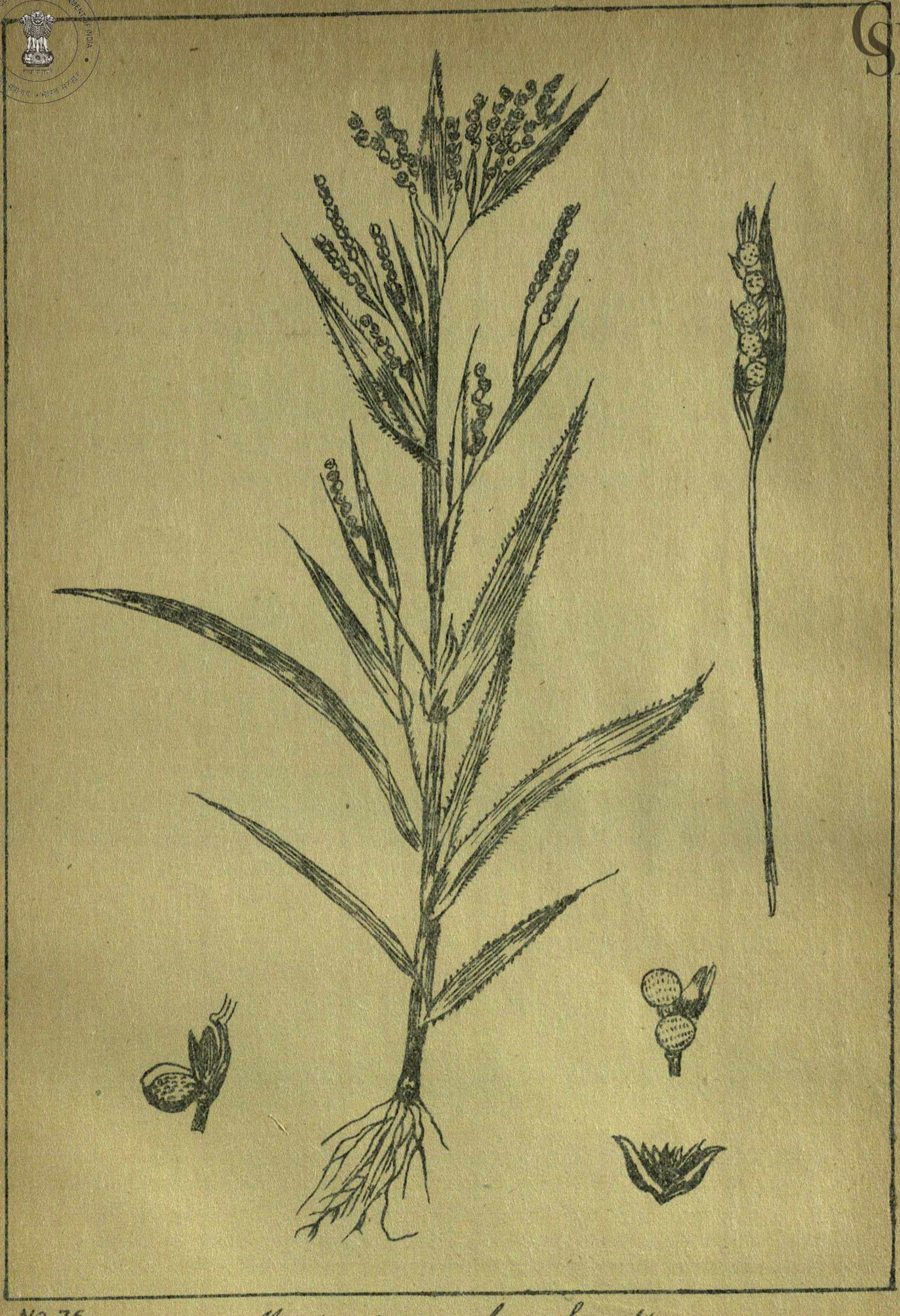

No. 36

Maniouris granularis, Swart.

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1. O. CORYMBOSUS, Gaertn. Kunth. Enum. I. 464; Roxb. Cor. Pl. 181.

Vern.—*Sputter, Sut, Sonthi, Katia, Karvel.*

Culm erect, smooth, 3—6 ft. Leaves few. Spikes fascicled. 2—5 in. long, on filiform peduncles, terminal, and from the axils of upper leaf sheaths; each peduncle with a long bract. 1st glume coriaceous, sometimes pitted or tuberculate; 3rd glume with a palea and male flower. Flowering glume with a hermaphrodite flower.

Habit.—Very common all over India. Used for thatching and tying bundles of grass; used as fodder when young or when other kinds of grass fail.

2. O. PERFORATUS, Trin. in Mem.; ROTTBŒLLIA PERFORATA, Roxb. Cor. Pl. t. 182; Fl. Ind. I. 356.

Vern.—*Sassur, Sagatna, Kurke.*

Culm erect, 3—5 ft. Rachis perforated so that the backs of the glume next the rachis touch each other. Spikelets solitary in the upper part of the spike, but 2 below, separated more or less by a longitudinal septum.

Habit.—Not uncommon all over Bombay, Madras, Nilghiris, Bengal, on the Himálayas up to 5,000 feet; also in Nepal and Ceylon. Said to be common in Satpuda, W. Khándesh (uplands). Used as fodder for cattle.

40. ELIONURUS, Humb. and Bonpl.

Spikelets in pairs, sessile and pedicellate in the alternate notches of the articulate axis of a simple, solitary and densely silky spike, with one hermaphrodite flower. 1st glume of the sessile spikelet, the largest, bifid or 2-lobed; the 2nd glume shorter, thin and pointed; 3rd and 4th thin and hyaline. All awnless. Pedicellate spikelet barren.

Species 12. Habit of Rottbœllia, but the spikelets are clothed with long hairs.

1. E. ROYLEANUS, Nees, Fl. Ind.; ANDROP. ELEGANTISSIMUS, Steud. Synop. Pl. I. 364; ROTTB. ELEGANTISSIMA, Hockst. Herb. Arab.

Culm cespitose 6 in.—1 ft. high, pilose at the nodes. Sheaths inflated, pilose at the mouth. Leaves narrow, 1—2 in. long. Outer glume of sessile hermaphrodite. Spikelet coriaceous, clothed with long silky hairs; apex deeply bifid; margins, specially of the lower half, toothed, the teeth ending in long white hairs. The

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other glume and palea smaller. All bright red in the specimens before me. *Pedicellate spikelet* consists of 2 large red, empty coriaceous glumes.

Habit.—Sind, where it grows on rocks or stony ground.

41. CLEISTACHNE, Benth.

Spikelets 1-flowered, solitary on the inarticulate branches of the panicle. Flowers hermaphrodite. Glumes 4; 2 lower ones empty, broad, rigid, embracing the flower; the 3rd shorter, empty, hyaline, ciliolate. Caryopsis enclosed within the lower hardened glume.

1. C. Stocksii, Hook. f.

Ligule oblong, spikelets dark-brown, margins of 4th glume entire; palea ovate-obtuse.

42. ANDROPOGON, Linn.

Spikelets in simple or panicled articulated spikes usually in pairs, one pedicelled, male only or reduced to a glume, and the other sessile with a hermaphrodite flower. The lower glume coriaceous larger than the others; the flowering glume thin with a long twisted awn. Each articulation or joint bears a pair of spikelets as mentioned above, 1 sessile, and 1 pedicellate.

Species about 100, spread chiefly in the warm and sub-temperate regions.

1. A. fastigiatus, Swartz.

Culm erect, 2—3 ft. glabrous. Sheath scabrous. Leaves narrow acuminate; 1—1½ in. long. Spikes solitary, enfolded at the base by a lanceolate acuminate bract. Lower glume of sessile spikelet white-pilose; 2nd broader, obovate, cuneate with a long straight awn; 3rd not awned; 4th with a stouter awn, somewhat bent.

Habit.—I believe it is rare in this Presidency; seen specimens from Khandwa, sent by the late Dr. Dymock. It grows also in Central India, tropical Africa and America.

2. A. foveolatus, Del. Descr. de l'Egypt.

Vern.—*Marwel, Boari, Kard, Gandhel.*

Culm slender, ½—2 ft., alternately flat between the nodes. Nodes hairy. Leaves narrow, short acuminate, with bulbous-based hairs at the base. Spikes solitary at the summit of the culm or of each branch, slender, with a spathe at the base. Lower glume of the sessile spikelet with a pit above the base; 4th glume with an awn. Some of the lower sessile spikelets are occasionally unawned, male or sterile. Lower glume of pedicellate spikelet is with or without a pit; 2nd equal to the lower. The remaining often absent.

Habit.—In E. and W. Khándesh, and in the Deccan on rocky grounds. Also all over India, and tropical Africa. Admitted to be good fodder.

3. A. STRICTUS, Roxb. I. 261.

This is described by Hackel as a variety of A. FOVEOLATUS. Its culm is more slender, the spikes seldom emerging out of their spathes. The lower glume of the pedicellate spikelet is with a pit.

4. A. PACHYARTHUS, Hack.; P. PUMILUS, Roxb. Fl. Ind. I. 273.

Vern.—*Lal-gavat* (so named from the red colour of the spikelet), *Tambrut*, *Gondad*, *Chiman*, *Chira*, *Malakava*.

Culm 6 in. to 1½ ft. Branches solitary or 2 from the nodes surrounded at the base with reddish bracts or spathes. Leaves glabrous, 1—1½ in. long. Racemes 2 on the top of branches Pedicellate spikelet consists of 3 glumes, the 4th absent.

Habit.—Very common in Poóna where large tracts of ground appear to be red owing to the colour of the bracts; also in Khándesh (West and East), N. Kánara and all over India. Reckoned to be good fodder, especially before it flowers. Duthie states that it is good for cattle but not for horses.

5. A. COMPRESSUS, Hook. fl.

Stem tall robust compressed, nodes glabrous, leaves long broad flat, sheaths compressed keeled, spikes very many densely subcorymbosely panicled pale flexuous silky, joints and pedicels very slender, sessile spikelets ⅙ in. ovate-lanceolate, callus hairs ⅓—½ the spikelet, 1st glume imperforate 5—7-nerved villous below the middle, keels minutely scabrid.

Stem 3—4-ft., as thick as a goose-quill at the base, erect, sparingly branched, leafy. Leaves 1—1½ ft. by ¼—⅓ in., finely acuminate, slightly scaberulous on the margins and both surfaces, a little hairy towards the base; sheaths strongly compressed and acutely keeled, uppermost forming a lanceolate spathe 4—6 in. long to the base of the panicle; ligule a ciliate membrane. Fascicles of spikes 4—5 in. long, erect, branches slender, lowermost ½ in. long, and rachis smooth. Spikes 1—2 in. branched at the base, firm, nearly white, callus hairs ⅓ the length of the spikelet. Sessile spikelets, joints and pedicels about = ½ spikelet, centre hyaline, upper hairs reaching the top of the sessile spikelet; 1st glume thin, margin narrowly incurved, tip truncate, hyaline; 2nd glume ovate, 1-nerved, tip hyaline; 3rd shorter, ovate obtuse glabrous nerveless; 4th glume, awn about $\frac{1}{3}$rd in., inconspicuously margined below. Pedicelled spikelets narrower than the sessile, hairs of callus half their length; 1st glume 9—11-nerved; 2nd 3-nerved; 3rd oblong, long-ciliate, nerveless.—Sent by Lisboa as *A. odoratus*, but apparently very different from the description of that plant and from the specimens received in the strongly compressed and acutely keeled sheaths, broad leaves and inflorescence.

Habit.—The Deccan, Lisboa (No. 6 A. ODORATUS), Woodrow.

6. A. WOODROWII, Hook. fl.

Stems tall erect compressed, nodes glabrous, leaves long sheaths compressed, spikes erect stipitate fascicled strict silky joints and pedicels slender ciliate with long erect hairs, sessile spikelets $\frac{1}{8}$—$\frac{1}{6}$ in. oblong lanceolate, callus hairs = $\frac{1}{4}$ of the spikelet, 1st glume of sessile spikelet 8—12-nerved silky below the middle, tip truncate hyaline, keels ciliolate.

Stems 3—4 feet tufted on a woody rootstock, thicker than a goose-quill at the base and obtusely 2-edged, solid, stiff, branched above. Leaves 1—2 ft. by $\frac{1}{8}$—1 in., rigid, surfaces and margins scaberulous, not pruinose beneath; sheath loose, keeled, quite smooth; ligule a truncate ciliate membrane. Spikes 3—5, $\frac{1}{2}$—1 in. long, pale, on slender but stiff smooth proper peduncles, $\frac{1}{8}$—$\frac{1}{2}$ in. long; joints and pedicels linear, margins silky, upper hairs half as long as the spikelet sessile spikelets, callus rather long, obtuse; 1st glume coriaceous, glabrous above the middle, margins narrowly incurved, nerves slender; 2nd glume chartaceous, 3-nerved, ciliate; 3rd ovate, acute, nerveless, glabrous; 4th a simple awn $\frac{1}{2}$—$\frac{2}{3}$ in. *Pedicelled spikelets* narrower than the sessile; 1st glume 9-nerved, glabrous, keels scabrid; 2nd 3-nerved, ciliate; 3rd obovate, ciliate, nerveless; apparently a very distinct species, of which better specimens are much wanted, the spikes being much broken. Mr. Woodrow observes that the odour is that of camphor.

Habit.—Bombay; Mával, Woodrow (Herb. Bombay No. 27).

7. A. PERTUSUS, Willd. Sp. IV. 922.

Vern.—*Ganya Marvel* (Sátára and Sholápur name), *Payen*, *Palva*, *Palwan*.

Culm decumbent at the base, ascending to 1—2 ft. high, Nodes bearded or glabrous. Sheath hairy at the mouth. Leaves tapering to a fine point. Spikes 5—6, crowded on the top of a slender erect peduncle. Rachis and pedicels, especially of the male spikelet, clothed with white hair. Spikelets purple. Lower glume of hermaphrodite spikelets clothed with silky hairs below, and a little above the middle marked with a pit. Awn 2—3 times as long as the spikelet.

Habit.—Common throughout India and in Africa. Is reckoned as good fodder. "This grass, which is met with all over the plains of Northern India, is universally esteemed as a good fodder grass, both for grazing and stacking. In Australia also it is highly valued, being regarded as one of the best grasses to stand long droughts, while it will bear any amount of feeding. It is useful also as a winter grass, if the weather is not too severe."—Duthie. I have not seen it eaten by cattle. There are two varieties of this species—one with two pits on the lower glume of the pedicellate spikelet, and the other with 3. This was collected by Major Serpa Pinto in Central Africa. The inflorescence of this grass is scented, a circumstance which is not noticed by any agrostologist I know of.

8. A. CONCANENSIS, Hook. fl.

Slender, erect, leafy, leaves very narrow, sheaths teretes nodes glabrous, spikes 5—8, 2—$\frac{1}{2}$ in. long loosely fascicled, long-stipitate slender flexuous pale, joints and pedicels slender compressed not deeply sulcate sparsely shortly ciliate, spikelets $\frac{1}{8}$ in. ovate—on oblong-lanceolate narrowly truncate glabrous 7-nerved keels very shortly ciliate.

Perennial. Stems many from a nodose stock 28—24 in. firms smooth, terete, leafy. Leaves 8—10 by $\frac{1}{12}$—$\frac{1}{8}$ in., finely acuminate, smooth on both surfaces; sheaths smooth; ligule a ridge. Spike, very pale, rachis and proper peduncles filiform, glabrous, the latter, $\frac{1}{2}$—$\frac{3}{4}$ in. long, axils slightly bearded; joints and pedicels = $\frac{1}{2}$ the lower spikelet, compressed, hardly grooved and not translucent in the centre, sides not thickened. Sessile spikelets small, callus hairs = $\frac{1}{4}$ the glumes; 1st glume thin, nerves very slender, keels ciliate with stiff very short bristles; 2nd glume lanceolate, acuminate, ciliate nerves 3 faint; 3rd glume much smaller, oblong, obtuse, nerveless; 4th glume awn $\frac{1}{2}$ in., capillary, base slightly dilated. Pedicelled spikelets narrower than the sessile, 1st glume 9-nerved; 2nd and 3rd as in the sessile; 4th small, oblong, often unequally 2-fid, ciliate nerveless. Although the pedicels of the upper spikelets and joints of the rachis are not as in typical AMPHILOPHIS, this appears to be the position of A. CONCANENSIS.

Habit.—Bombay, Woodrow (Herb. Bom. No. 28).

9. A. KUNLZEANUS, Hack. Monogr. Androp. 478.

Culm 3—5 ft. high. Nodes thickly bearded with 1—3 slender flowering branches. Sheaths terete, glabrous. Leaves 10 in.

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or more, glabrous, narrow, linear, setaceo-acuminate; margins scaberulous; upper short rigid. Spikes slender, flexuose, silky, purplish; joints and pedicels ciliate with long hair. Sessile spikelets $\frac{1}{5}$ in. narrow. 1st glume glabrous pitted or not, 7—9-nerved; 2nd glume acuminate or mucronate; marciliate; 3rd glabrous; 4th an awn about $\frac{1}{2}$ in. Pedicellate spikelets narrower than the sessile, male; 1st glume 9—11-nerved; keel ciliate, scabrid at the tip; 2nd glume 5-nerved; 3rd glume ciliate; nerveless. 4th small or absent. It approaches much *A. Hugelii*.

Habit.—The Konkan and Central Provinces.

10. A. ENSIFORMIS, Hook. fl.

Stem erect stout compressed, nodes glabrous, leaves erect strict narrowly ensiform acuminate, sheath strongly compressed, spikes many in a thyrsiform fascicle shortly stipitate, joints and pedicels silky with long hairs, sessile spikelets $\frac{1}{5}$ in. ovate-oblong, callus hairs = $\frac{1}{2}$ the spikelet, 1st glume membraneous dorsally flat 5—7-nerved very sparsely silkily villous towards the base, tip truncate, keels minutely ciliate.

Stems 2 feet and upwards, densely tufted, base as thick as the thumb, with stout roots, clothed with the compressed equitant leaf-sheaths. Leaves 8—10 by $\frac{1}{3}$—$\frac{1}{2}$ in., rigid, strongly nerved, glabrous or sparsely hairy, tips acicular, margins and both surfaces scaberulous; sheaths smooth, lower equitant; ligule short, scarious. Spikes $\frac{1}{2}$—$\frac{2}{3}$ in., in an erect narrow thyrsus 3 in. long, pale purplish, proper peduncles $\frac{1}{6}$—$\frac{1}{4}$ in.; joints and pedicels very slender, flat with a translucent channel, ciliate with very long erect hairs. Sessile spikelets callus small; 1st glume thin, shining, margins rather narrowly incurved, keels slender; 2nd glume ovate-oblong, acute, 3-nerved, ciliate, not keeled; 3rd narrowly oblong, ciliate; 4th a very narrow entire or 2-toothed membraneous dilatation of the base of the slender awn, which is $\frac{1}{2}$—$\frac{2}{3}$ in. long. Pedicelled spikelets as long as the sessile, linear-oblong; callus naked; 1st glume convex, many-nerved; 2nd 5-nerved; 3rd linear-oblong, ciliolate; I have seen only a single specimen from the Herbarium of the late Mr. A. Dalzell, with no locality marked. The straight sword-shaped leaves are remarkable.

Habit.—The Konkan (?) Dalzell.

11. A. INTERMEDIUS, R. Br.

Vern.—*Kolum?*

It is intermediate between A. ISCHŒMUM, Linn., and A. PERTUSUS, Wild. Resembles these species in general appearance, but the panicles are more loose and more elongated. A tall coarse grass with long narrow leaves used in Mahábaleshvar for thatching.

GSL

Culm 3—5 ft.; usually stout, slightly flattened on one side; nody with or without hairs. Thistles hairy at the mouth. Ligula very short. Leaves narrow, linear 6—18 by $\frac{1}{6}$—$\frac{1}{3}$ in. flat, glaucous, long, acuminate, hairy at the base. Panicle 3 in. long, very fragile consisting of slender, usually numerous spikes 1—2 in. long.

Spikelets green or purplish. 1st glume obtuse 4—7-nerved; 2nd oblong or lanceolate, 3-nerved; 3rd nerveless; 4th a slender awn 1—$1\frac{1}{2}$ in. long. 1st glume often but not always, even in the same spike, marked with a dorsal pit, pedicellate spikelets linear oblong. 1st glume scabrid at the keel; 2nd ciliate; 3rd shorter; 4th none. It is a tall coarse grass, very variable and approaches A. ODORATUS, Lisb., and A. KUNTZEANUS, Hack.

12. A. PUNCTATUS, Roxb. I. 264.

Vern.—*Kunda.*

My specimens are from Poona and E. Khándesh. In the latter place they were collected in the villages of Jalgaon, Amalner and Páchora. Said to be used as fodder and in thatching.

Prof. Hackel describes it as a variety of A. INTERMEDIUS, R. Br., but is distinguished from it by a shallow pit on the outer glume of the sessile and pedicellate spikelet.

The Seoni specimens have 3 shallow pits on the lower glume of the sterile florets, and one deep pit on the lower glume of the hermaphrodite floret.

Habit.—Found in the hilly parts of Northern India; abundant on the Himálayas up to moderate elevations.

13. A. GLABER, Roxb. I. 267.

Vern.—*Tambat.*

This is also given as a variety. 1st glume of the pedicellate spikelet without pit. Glumes with or without pits are sometimes to be found in the same spike.

Habit.—It is one of the common fodder grasses of the Deccan. Is thinly scattered on somewhat elevated parts of Bengal. Grows also in N.-W. Provinces, but not in abundance.

14. A. MONTANUS, Roxb. I. 267.

Culm decumbent and rooting at the base, ascending to 3—4 ft. Sheath hairy at the base. Leaves 2—6 in., sparsely hairy towards the base. Spikes 2—3 in. long with a few hairs at each articulation. Lower glume of sessile spikelet 2—5-nerved; 4th glume reduced to a twisted awn 8—9 lines long. Pedicellate spikelet male and awnless.

GSL

A. GLAUCOPSIS, Steud., and A. SUBREPENS, Steud., are varieties of the last, known by glaucous leaves and small spikelets. The pedicellate spikelets are sometimes neuter.

Habit.—Dhárwár; specimens sent by Mr. Talbot. This grass grows in various parts of India, the Himálayas and also in Nepal, Burma and Canton.

15. A. ODORATUS, Mrs. Lisboa.

Vern.—*Vaidia-Gavat, Usadhana, Bhos, Tambrut.*

Culm 3—5 ft. high often branching from the base, glabrous. Nodes long-bearded. Leaves from a cordate base, acute or acuminate with a few long hairs; lower leaves long, the upper short, but their sheaths very long. Spikes numerous, branches congested at the end of a long peduncle, without a sheathing bract, and forming an erect dense, ovoïd panicle. Rachis, pedicel and spikes clothed with long silky hairs. Spikelets 2 lines long, of a purple colour; the sessile and the pedicellate similar. Lower glume of the sessile spikelet many-nerved, clothed with long, white silky hairs with a pit in some spikelets and absent in others; 2nd glume a little broader and keeled; 4th a small glume or reduced to an awn $\frac{1}{2}$—1 in. long. Pedicel of the pedicellate spikelet with white hairs, but the spikelet almost free from hairs. Lower glume with 5 or more, not prominent, nerves; 4th glume male, stamens smaller than those in the hermaphrodite flower. No awn.

Very common at Lanowli and in the neighbouring villages; at the end of the rains the fields present a beautiful purple colour. The *Pharmacographia Indica* says: "In 1889, this grass was found growing abundantly at Lonávla on the W. Ghâts by Mrs. Lisboa and was described and figured in the *Journal of the Bom. Nat. Hist. Society*. We have since distilled the grass, and obtained from it an essential oil, having at first an odour recalling that of Cassia and rosemary, but afterwards a strong persistent odour of oil of Cassia. Messrs. Skimmel & Co. noticed the odour of pine needle oil in this sample and found the specific gravity to be 945." Mr. Prebble, of Messrs. Kemp & Co., was the first to extract a small quantity of oil from it. This he did at the request of Mrs. Lisboa, who showed it at one of the meetings of the Bomb. Nat. Hist. Society. The grass is said to be not uncommon at Khardi, Thána. It differs from A. INTERMEDIUS by its long white hair, the leaves and the inflorescence being highly scented. A. INTERMEDIUS is very rare in Bombay.

16. A. MICRANTHUS, Kunth. Revis. Gram. I. 165; Enum. Pl. I. 504.

Stem erect or ascending, simple or nearly so, leaves linear, base hardly narrowed, sheaths closed, spikes of 2—3 pairs of spikelets,

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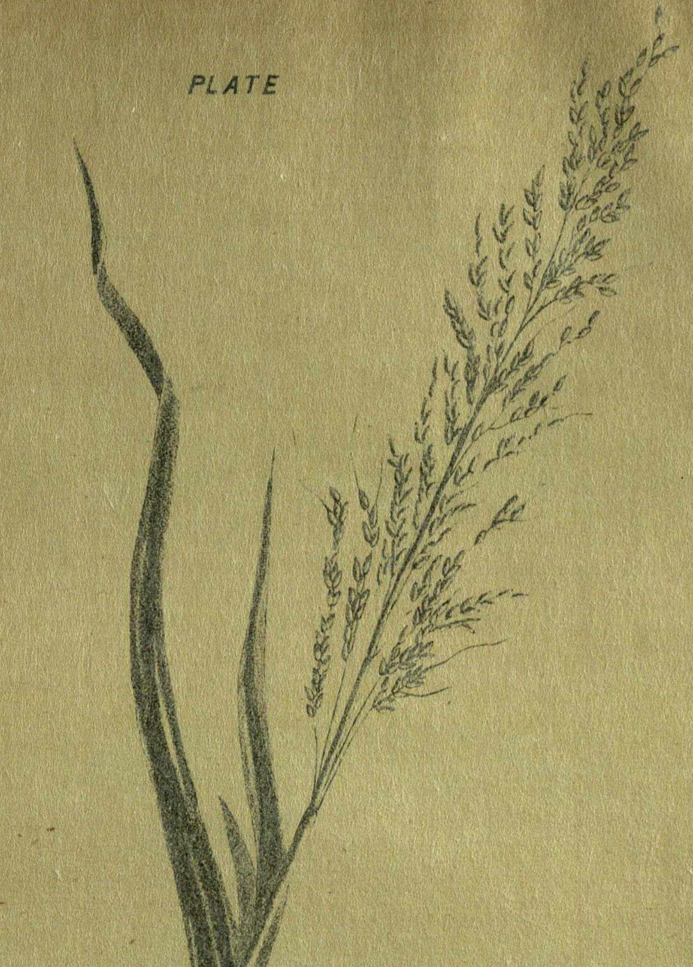
PLATE



a - Outer pitted glume of the pedicillate spikelet.

NO.37

DRAWN FROM NATURE BY M.E.R.

Andropogon odoratus. Lisboa.

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joints and pedicels shortly ciliate or subglabrous, sessile spikelets $\frac{1}{10}$—$\frac{1}{8}$ in., 1st glume linear-oblong dorsally channelled glabrous scaberulous or villous, keels minutely subpectinately ciliate. Steud. Syn. Gram. 396; Hack. Monogr. Androp, 488; Lisboa in Journ. Bom. Nat. Hist. Soc. IV. (1889), VI. (1891) 69. A. ALTERNANS, Presl. Reliq. Hænk. I. 342; Kunth. Enum l. c. 502. A. CŒRULESCENS; Kunth. l. c. 504. A. CAPILLIFLORUS, Steud. in Zoll. Syst. Verz. 58. A. PARVISPICA, Steud. l. c. 397. A. SERRATUS, Miq. Prolus. Fl. Jap. I. 192. ANATHERUM PARVIFLORUM, Spreng. Syst. I. 290. CHRYSOPOGON VIOLASCENS, Trin. in Mem. Acad. Petersb. Ser. VI. II. (1893) 319. SORGHUM PARVIFLORUM, Beauv. ex. Rœm and Sch. Syst. II. 840. RHAPHIS CŒRULESCENS, Desv. Opusc. 69. R. MICROSTACHYA, Nees. ex. Steud. l. c. 397. HOLCUS CŒRULESCENS, Gaud. in. Freye. Voy. Bot. 411, t. 27. H. PARVIFLORUS, Br. Prodr. 199.

Stem 2—3 ft., as thick as a crow-quill or thicker, terete nodes more or less bearded. Leaves 6—12 by $\frac{1}{6}$—$\frac{1}{4}$ in., setaceously acuminate, flat, more or less hairy with tubercle-based hairs surfaces and margins scaberulous, base rounded; sheaths tight, ligule short, truncate. Panicle 2—6 in., oblong or pyramidal; rachis and branches spreading, perfectly smooth, flexuous. Spikes $\frac{1}{5}$—$\frac{1}{3}$ in., pale yellow violet or red-brown, joints and pedicels slender often ciliate on one margin only. Spikelets small, callus stellately bearded; 1st glume narrowly truncate, 4—6-nerved, scaberulous in all the specimens I have examined; margins narrowly inflexed; 2nd glume lanceolate, acuminate or mucronate, scaberulous, 1—3-nerved; 3rd glume short, obtuse, eciliate, nerveless; 4th glume, awn $\frac{1}{3}$—$\frac{2}{3}$ in. Pedicelled spikelets male, callus naked; 1st glume oblong; 7-nerved, margins hardly inflexed; 2nd oblong, obtuse, 3—5-nerved; 3rd oblong, hyaline; 4th narrow, awnless.—Spikes often reduced to 3 spikelets, a sessile and 2 pedicelled males.—I have not cited Hackel's Synonymy and authorities for the non-Indian forms with more spikelets in each spike. It is very difficult to distinguish A. MICRANTHUS from small forms of A. ASSIMILIS. I have seen no specimens from Lisboa.

Var. VILLOSULUS, Hack. l. c. 490.

Usually much stouter, sheaths bearded at the nodes and leaves hispidly hairy; 1st glume of sessile spikelets often hispidulous. A. VILLOSULUS, Steud. Syn. Gram. 397; Lisboa in Bomb. Journ. Nat. Hist. VI. (1891) 69—VILLOSUS. CHRYSOPOGON VILLOSULUS, Nees ex Duthie Grass. N. W. Ind. 23 (excl. Some. Syns.). C. MONTANUS, Duthie. Grass. N. W. Ind. 40. RHAPHIS VILLOSULA.

Habit.—Western Himálaya, from the Ravi to Kumaon, alt. 4—6,000 ft.; Khasia Hills, alt. 5,000 ft., Clarke. The Nilghiri, Koncan and Deccan Hills.—Distribution Æ. East Asia and Malaya, Australia, South Africa.

17. A. ASSIMILIS, Steud. in Zoll. Syst. Verz. 58, Syn. Gram. 397.

Suffruticose, fastigiately branched from a decumbent base, leafy, leaves linear lanceolate much narrowed to the base, lower sheaths open, branches of pyramidal panicle capillary at length widely spreading, joints and pedicels shortly ciliate, sessile spikelets $\frac{1}{10}$—$\frac{1}{8}$ in., 1st glume oblong or linear-oblong narrowly truncate glabrous or silkily villous below the middle, 2—5-nerved between the shortly pectinately ciliate keels. Miq. Fl. Ind. Bot. III. 489. A MONTANUS, Benth. Fl. Hongk. 423 (excl. Syn.); Hack. Monogr. Androp. 491 (excl. Syn.); Lisboa in Journ. Bomb. Nat. Hist. Soc. VI. (1891) 203. A. CAPILLACEUS, Wall. MSS. A. GLAUCOPSIS and SUBREPENS, Steud. l. c. CHRYSOPOGON PICTUS; Hance in Ann. Sc. Nat. Ser. 5, V. (1866) 252. C. GLAUCOPSIS, Duthie Grass. N. W. Ind. 22. RHAPHIS REPENS, Nees. ex Steud. l. c.—Chrysopogon, Wall., Cat. N. 8781, 8786, 8787, 8790.

Stems. 6 to probably 12 ft. or more; as thick as a goose-quill at the base, hard, shining, sometimes proliferously branched here and there, nodes more or less bearded. Leaves $2\frac{1}{2}$—6 by $\frac{1}{10}$—$\frac{1}{5}$ in., setaceously acuminate, rather flaccid, glabrous or sparsely hairy on both surfaces, margins subserrulate; sheaths usually bearded at the mouth, upper appressed, lower open and often divaricate; ligule obscure. Panicle 2—5 in. triangular, ternately branched; rachis and branches capillary, glabrous, axils more or less bearded. Spikes $\frac{1}{4}$—$\frac{1}{3}$ in., joints and pedicels very slender, hairs not longer than the joint. Spikelets pale green; 1st glume membranous; margins incurred sometimes ciliate with a few very long hairs, flat or concave towards the centre; 2nd glume acute, margins nearly glabrous, keel flattened ciliolate above; 3rd glume ovate, obtuse, glabrous; 4th glume awn $\frac{1}{5}$—$\frac{1}{2}$ in., slender, base acute. Pedicelled spikelets larger than the sessile, male or neuter; 1st glume linear-lanceolate, green or reddish, glabrous or ciliate, 7-nerved, keels ciliolate; 2nd 3—5-nerved; 3rd $\frac{1}{3}$ shorter, oblong, glabrous, nerveless. I have seen no Javanese or other authentic specimens, and hence assume the correctness of Hackel's identification of the Indian plant with it. It is certainly not Roxburgh's A. MONTANUS.

Habit.—Temperate Himálaya, from Kashmir to Sikkim, ascending to 5,000 ft. The Khasia and Manipore Hills. Behár; on Párasnáth, alt. 4,000 ft. Burma, Wallich. Rájputána, Duthie. The Deccan and Central India, King, &c. Distribution Java, China, Japan.

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18. A. HUGELII, var. FŒTIDUS, Hack. Lisboa, Jour. Bomb. Nat. Hist. Soc.

Vern.—*Podan, Chiman-sar, Kavla-Sippee, Tam, Kullus, Padra.*

Culm slender, decumbent and rooting at the base, then ascending to $2\frac{1}{2}$—4 ft. high or more, grooved on the side of leaves and branches, glabrous, of a pale purple colour. Nodes bearded with white hairs. Ligula truncate, ciliate. Leaves 5—8 in. by 6 lines, acute with a few hairs on the lower surface, fewer or none on the upper, distinctly divided into 2 unequal parts by a white rib, prominent on the lower surface. Panicles 5—7 in. long, oblong, much branched, supported on a long peduncle. Rachis of a faded purple colour, smooth or scabrous from minute tubercles. Articulations 6—9 or more. Branches many at each joint (6—12 at the lower joints), capillary, smooth or scabrous, semi-verticelled, unequal in length, the longest 5—6-jointed. Articulations of the rachis and primary branches swollen and bearded with long soft white hairs. Primary branches give out at each joint 2—4 secondary branches, and these in their turn small tertiary ones; the ultimate branches and the primary small ones bearing 3 terminal spikelets, 1 sessile between 2 pedicellate, and generally 3 pairs below the triplet. Racemes very fragile, supported on peduncles free from hairs. The articulations of racemes and pedicel of the pedicellate spikelet short-hairy. Both spikelets yellowish-white or dingy green with a tuft of hairs at their base. 1st glume of the sessile spikelet 7—9-nerved; 2nd broader, 5-nerved; 3rd not seen (absent in all the specimens examined); 4th a slender twisted awn, 1 in. long with an hermaphrodite flower. 1st glume of the pedicellate spikelet ciliolate at the margins, many nerved; 2nd glume 3-nerved; 3rd broader than the 2nd, hyaline; 4th none. Stamens 3, 1 line long.

At the time that this was described minutely, Mr. Hackel had not published his description.

Habit.—It grows all over the Presidency, especially in Bassein, Thána, and over the Gháts; also in other parts of India. The inflorescence is scented, the odour being soft and pleasant, or "deliciously scented" in the words of Duthie.

19. A. FILICULMIS, Hook. fl.

Annual, stem elongate filiform flaccid much branched, nodes bearded, leaves 2—4 in., linear-lanceolate finely acuminate flaccid, base suddenly narrowed, sheaths lax lower open, panicle long-peduncled lax-flowered; rachis and branches capillary, pedicels of upper spikelets ciliate with long hairs, sessile spikelets $\frac{1}{10}$—$\frac{1}{8}$ in.

GSL

oblong, lanceolate, obtuse 5—7-nerved between the keels, villous below the middle or all over, keels ciliate with long slender hairs.

Stems 2 – 3 ft. apparently decumbent and interlaced, copiously geniculately branched throughout, quite glabrous, very weak, internodes long pubescent. Leaves pale-green $\frac{1}{8}$—$\frac{1}{6}$ in. broad, tip filiform, glabrous or sparsely hairy beneath, margins smooth ciliate towards the very narrow base, costa and nerves very slender; sheaths long, narrow, spreading at the ramifications, glabrous, bearded at the top; ligule broad, membranous, ciliate. Panicle 1—2 in., branches few of extreme slenderness. Spikelets pale-green or white; callus densely shortly villous; 1st glume of sessile membranous, nerves faint; 2nd glume oblong, truncate, micronate, 3-nerved, glabrous; 3rd glume very small, ovate, nerveless, eciliate; 4th glume awn $\frac{1}{2}$—$\frac{3}{4}$ in., column brown twisted. Pedicelled spikelets narrower than the sessile; 1st glume lanceolate, tip truncate mucronate, 7—9-nerved, ciliate, with long hairs; 2nd as long, ovate-lanceolate, acute, strongly 5—7-nerved; 3rd broadly oblong, hyaline, nerveless; a very delicate grass. The sessile spikelets of Jacquemont's specimens are nearly glabrous, of Woodrow's densely villous, with snow-white hairs.

Habit.—The Deccan; Poona, in rocky places, Jacquemont (No. 310); Mával, Dhonsha, Woodrow (Herb. Bomb. No. 26).

Subgenus VI.—SORGHUM.

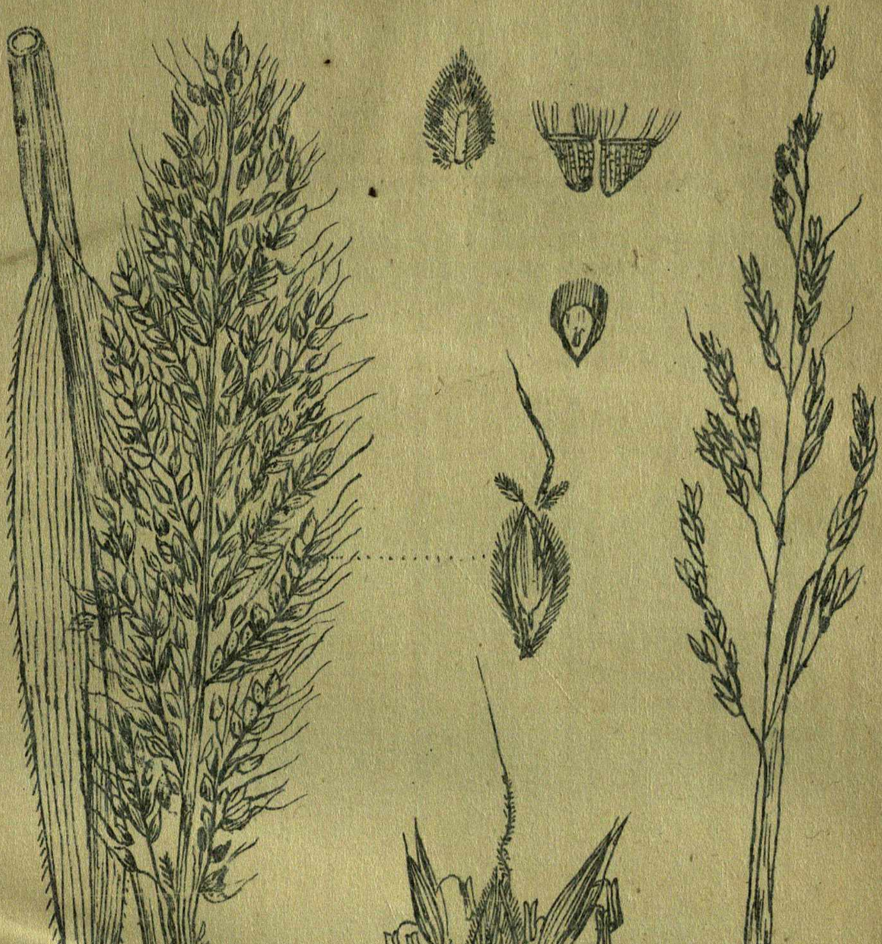
The arrangement of the spikelet is similar to that of CHRYSOPOGON, but SORGHUM differs from it mainly by the panicle branches being dense, by its larger grains, and the more rigid texture of its empty glumes.

20. S. HALEPENSE, Pers.

Vern.—*Barru*, *Bara*, *Kartal*, *Dacle*, *Batal*.

Culm 2—4—8 to 10 ft. Leaves narrow at the base, 8—12 in. by 1 in., glabrous. Panicle pyramidal, 3—4 in., branches numerous, dense, seldom loose. Hermaphrodite spikelet, 2—3 lines long, greenish white or pale purple. 1st glume coriaceous, 5—7-nerved; 2nd glume 5-nerved with a few hairs at the base; 4th glume 2-lobed, with a fine short twisted awn, from the notch; sometimes mutic. Pedicellate spikelet male or mutic.

Mr. Duthie says: "Common in India in cultivated and uncultivated ground. It is considered to be a good fodder grass, both for grazing and as hay. Various reports, however, indicate its injurious effects on cattle if eaten when too young, or when the plants are stunted by drought. The same results have been



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Andropogon halepense, Pers.

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observed to take place in the case of *juár* (SORGHUM VULGARE). Dr. Stewart was told in Hazara that cattle after eating it are often attacked by fatal head affections. In Gujranvála, Gujarát, and Sháhpur districts, it is said to be poisonous until the rains are over, when the cattle eat it with impunity. Tod in his "Rájasthán," Vol. II, p. 70, mentions that the seed of this grass is collected and mixed with bájra flour (PENNISETUM TYPHOIDEUM), and is eaten by the poorer classes in Bikánir. In Australia it is valued both for pasture and hay, and is much sought after by cattle. Native pens are made from the stems of this plant. No allusion is made regarding the injurious properties of this grass when young either in Australia or in the United States of America. In the latter country, where it is known as 'Johnson's Grass,' 'Cuba Grass,' 'Mears Grass' and 'False Guinea Grass,' it is highly valued, as the following extract from Dr. Vasey's "Report on the Grasses of the South," pp. 16 and 17 (1887), will show:—"Mr. N. B. Moore has cultivated this grass for 40 years and prefers it to all others, is perennial, as nutritious as any other, difficult to eradicate, will grow on ordinary soil, and yields abundantly. Horses and cattle are fond of it, both in its dry and green condition. Probably no grass gives better promise for the dry and arid lands of the West. This grass is best adapted to warm climates, and has proved most valuable on warm dry soils in the Southern States. Its chief value is for hay in regions where other grasses fail on account of drought. If cut early, the hay is of good quality, and several cuttings may be made in the season."

"In California it is known as 'Evergreen' or 'Arabian Millet.' It roots deep in the subsoil, and where that is at all alkaline, it grows enormously but at the same time absorbs so much of the unpalatable alkali, that stock will not eat it. It is excellent for dry hills, free from alkali."

Habit.—This grass grows all over the Deccan, Gujarát, Dhulia and Bassein, where it is considered to be a good fodder grass for cattle.

ANDROPOGON LAXUS, Roxb. Fl. Ind. I., 271. This is probably a variety of A. HALEPENSIS, Brotero, with loose panicle.

ANDROPOGON WIGHTII, Hack.; ANDROPOGONEÆ 511, is probably a variety of A. (SORGHUM) LUXUS of Roxburgh. I have received specimens from Thána and Násik.

21. A. SORGHUM, Brotero, Fl. Lusit.; Roxb. Fl. Ind. I. 88; HOLCUS SORGHUM, Linn.

Vern.—*Joundhla*, *Juvaree*, *Juar*, *Burroo*.

Culm erect, stout. Leaves broad, narrow at the base; midrib prominent below, channelled above. Panicle 4—8 in., ovate, much branched. Spikelets at first greenish white or yellowish, but in time rufous or brownish as in the last species. Sessile spikelet fertile, awned. Pedicellate male, mutic. Glume hard cartilaginous.

Habit.—Cultivated in various districts of this Presidency, chiefly in the Karnatak, in Berár where its grain is the common food of the poorer classes. Also extensively cultivated for fodder only, the seeds being then sown in close proximity to one another, when the stalk grows very tall, often reaching a height of 15 ft. or more. Thus grown, it is known by the name of *Karbi.* It is stated by Duthie that if eaten when too young, it proves injurious to cattle.

22. A. SORGHUM, Brot. var. CERNUUS.

Vern.—*Shaloo, Soondia.*

Is a variety of the last. Panicle oval, dense, drooping from the weight of the fruit. Spikelets at first whitish, in time brown, densely villous. Pedicellate spikelet neuter or male, mutic.

Habit.—Cultivated chiefly for its grain in the cold weather in some districts of the Deccan and Gujarát. In the Broach Collectorate, it is grown in the Deybarra and other districts and known there by the name of *Soondia.* The stalk as a forage for cattle is unsurpassed, as it contains a great deal of saccharine matter and is thus very nutritive. This species is said to be found growing wild in various districts of Bombay.

23. A. MILIACEUS, Roxb. I. 273. A variety of A. HALEPENSE.

Vern.—*Narvas, Bhondu.*

Culms erect, glabrous, 6—10 ft. Sheaths hairy at the mouth. Leaves lanceolate, 2—3 ft., glabrous; margins scabrous, with bristles pointed forward. Panicle large decompound; branches long, slender, drooping, verticelled. 1st glume of the sessile spikelet hairy, the pedicel glabrous; 4th glume hermaphrodite, sometimes awned.

Habit.—Poona (rare), Lanowli (saw only one specimen). Also on mountains north of Oude. This is a very tall stately grass, presenting a beautiful appearance when in inflorescence, which is of a purplish colour. Nothing is known of its uses.

24. A. SORGHUM, Brot. var.

Vern.—*Imphee.*

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Cultivated throughout Africa not so much for the sake of its grain as for sucking its sweet culm ; in America for the extraction of sugar and in Italy for making brooms. Brooms are also made of S. TECTNICUS. It is stated in Dalz. and Gibs. Bomb. Fl. that it was introduced about the year 1849 for the manufacture of sugar.

It is not uncommon over various districts of Poona.

Juar is extensively grown in India and Africa. In the Bombay Presidency including Sind there were in 1889-90 devoted to its cultivation 8,282,876 acres of land, and only 2,311,558 acres for wheat and very nearly the same amount for rice. Three crops are annually raised on this side : the early sown or *kharif* crop red and white, the late sown or *rabi* all white, and the irrigated hot season crop for fodder. The early or *kharif* crop is not common in the Deccan, being replaced by bájri. In Khándesh generally there is only one crop sown after cotton.

Juar is preferred by people of the places where it is grown, because it is said to be easily digested. It is eaten in the form of cakes, and often baked as maize.

The chemical composition according to Prof. Church is as follows :—In 100 parts, there is of water 12·5, albuminoids 9·3, starch 72·3, oil 2·0, fibre 2·2, ash 1·7.

Dr. Watt states that the spikes of *juár* are attacked by *rust*, *smut* and *bunt* and by insects, birds, jackals, rats, wild pigs, squirrels and white ants. It is stated above that the fodder acts as a poison to cattle, producing a disease by which digestion is impaired, gas generated in the stomach so as to cause excessive distension of the abdomen.

These effects are attributed by natives and Europeans to an insect named *Baunri*, which like the borer of sugarcane is found burrowing into the culm of *juár* and which makes its appearance specially when rain is deficient. It is not well ascertained whether the injurious effects on cattle are due to this insect or to climatic influences, the excessive drought causing fermentive alteration of the sap or the tissues of the culms.

It is stated that in some parts of India two small plants belonging to SCROFULARINEÆ, STRIGA EUPHRASIOIDES, Benth., and STRIGA LUTEA, Low., cause great damage by depriving the crop of their nutriment.

With the view of calling the attention of the cultivators of this side of India, I have alluded to the pests occurring in other

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provinces. Some of these are not mentioned in the reports of the cultivation of *juár* in Bombay.

The culm of *juár* is more nutritious than of *bájri* and *rice*.

25. A. SERRATUS, Grah. Cat. Bomb. Fl. 238.

A. TROPICUS, Benth. Fl. Hongk. 423.

Culm 3—4 feet, slender; nodes bearded with dense tuft of short hairs. Sheaths keeled above more or less hairy, Leaves 4—20 inch long, narrow finely acuminate, scabrous margins, mid-rib broad. Panicle 4—10 in. long, rather loose. Spikes red brown, in rather distant whorls. 1st glume of sessile spikelet dark brown; 2nd rather longer, lanceolate acute, 1-nerved; 3rd shorter, acute; 4th small, entire, or 2-lobed with a twisted awn. Awn sometimes wanting. Pedicellate spikelet narrow and paler, male or neuter and awnless; 1st glume 7-nerved; 2nd 3-nerved.

Habit.—Konkan, Dhárwár.

26. A. PURPUREO-SERICEUS. Hochst. (In College of Science collection.)

Stem 3 to 6 ft. in height, thickness $\frac{1}{8}$ in. diameter, nodes white and hairy. Sheath 4—5 in., prominently many-nerved, hairy and hirsute. Laminæ 8 in. by $\frac{1}{2}$ in., with a prominent midrib and 8 slender nerves bearing upcurved stiff hairs. Inflorescence paniculate; branches capillary, smooth; spikelets in 3—4 triplets, 1 spikelet sessile and 2 pedicellate, the pedicel of one of the pedicellate frequently wanting; sessile spikelet hermaphrodite 1-flowered. 1st glume $\frac{7}{40}$ in. coriaceous, having stiff reddish-brown hairs on dorsum; 2nd glume similar to 1st glume, but with less hair; 3rd glume hyaline, smaller than the 2nd. Flowering glume hyaline, bearing from dorsum, *generally* a long bent yellow or red awn. Palea hyaline, same size as 1st glume. Lodicules very small. Pedicelled spikelets 1-flowered. 1st glume $\frac{3}{20}$ in. 5-nerved, with stiff ascending reddish-brown hairs at base; 2nd glume similar to the 1st; 3rd glume hyaline, equal in size to the 2nd; 4th glume hyaline. Stamens 3. Styles free to the base, flattened. Stigmas penicillate, golden brown.

Habit.—Lanowli and Poona and over Ghâts. Looks very pretty when seen mixed with other green grass. Uses not known.

Subgenus VII.—VETIVERIA, Hack.

Spikes panicled, branches of panicle many, whorled; joints 3 or more and pedicels linear filiform dorsally convex not channelled, tip truncate. Sessile spikelets laterally or dorsally compressed, awned or not; 1st glume coriaceous, narrow margins inflexed or

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involute, keels muricate; 2nd glume awned or not; 3rd hyaline; 4th entire or 2-fid awned. Lodicules glabrous.

But distinguished from CHRYSOPOGON by the absence of a beard of rigid hairs on the tip of the branchlets, seen after the fall of the spike. A. VENUSTUS is removed to AMPHILOPHIS.

27. A. SQUARROSUS, Linn. Dalz. and Gibs. Bomb. Fl. 302; A. MURICATUS, Retz. Obs. 3; VITIVERIA ODORATA.

Vern.—*Valeru* or *Valerum, Walla, Vallo, Ushir* and *Vittiver* (S. India names). The aromatic roots are known as *Kaskas.*

Roots thick. Culm erect, 4—6 ft. Leaves linear-narrow, the lower longer 1—1½ to 2 ft., rigid, glabrous. Panicle verticelled. Glumes prickly or muricated, of a purplish violaceous colour.

This is a well-known grass, the roots of which are aromatic, particularly when moistened with water, and from which tatties and fans are made; in some parts of India they are used in the manufacture of ropes and in that of brushes made by weavers for arranging the threads of the web. Baskets (sometimes dyed) are made of the stems. In Oude a perfume called *Itar* is extracted from the roots and used medicinally under the name of *uraiya.* In Europe an oil is distilled which commands a high price, being used in the composition of many favourite perfumes as *Manseline des Indes, Marshal, Bouquet du Roi,* &c.

Subgenus VIII.—CHRYSOPOGON.

Spikelets 3-together terminating the articulated branchlets of a panicle, the central one sessile and fertile, and the lateral pedicellate and male or reduced to empty glume with occasionally 1—3 pairs of spikelets below the triplet. Sessile spikelet with 4 glumes; 1st larger than the rest; 2nd occasionally with a straight awn; 3rd very small; 4th 2-fid, with a thin or strong twisted and bent-back awn.

Species 20 spread over the tropical and temperate regions.

28. A. GRYLLUS, Linn.; Trin. Fundam. 188; HOLCUS GRYLLUS, R. Br. Prodr. 199.

Culm 2—4 ft., glabrous. Leaves 8—12 in., glabrous or with a few hairs. Panicle 3—6 in. with numerous capillary, verticelled branches, of unequal length, hairy in the axils or glabrous. Spikelet surrounded at the base by brownish hairs. 1st glume of the sessile spikelet rigid, cartilaginous, acute, indistinctly 5—7-nerved, muricate, specially at the margins above; 2nd glume scabrous above

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and terminated by a thin straight awn; 4th glume with a twisted and bent awn. Lower glume of the pedicellate spikelet tapering into a very fine short awn. The other glumes mutic.

Habit.—Seen specimen of one of its varieties named C. GLABRATUS, Steud. Syn. Gram. 395 from N. Kánara. It is reckoned to be a good fodder in Australia.

29. A. ACICULATUS, Trin.; Dalz. and Gibs. Bomb. Fl. 303; Trin. Sp. Gram t. 183; RAPHIS TRIVULUS, Trin. Sp. Gram t. 8, 9.

Vern.—*Sans, Shuntinee, Chora-pooshpee, Keshinee, Chora-kanta.* (R.)

Culm rooting at the base, 1—2 ft. high, glabrous. Sheaths long. Leaves many, crowded chiefly near the base, 2—3 in. by 2—3 lines; margins prickly. Panicle terminal, dense, 1—4 in. high; branches numerous, ascending. Glume of the fertile spikelet bifid, with an awn twice the length of the spikelet. Pedicellate spikelet male, pedicels not ciliate.

Habit.—Grows all over India on barren moist pasture ground; its seeds are exceedingly troublesome to those who walk where it grows; they stick in the stockings and produce a disagreeable itching. Cattle are not fond of this coarse grass (Roxb.). This grass, named *tuteri* or *rat tuteri* in Ceylon, is very common there. "There is a story told about the late Sir Emerson Tennent having come in from a walk in Kandy covered with this grass, and on asking a Moodliar what it was, got in reply 'only a Tuteri, Milord.' The knight mistaking the information for bad English, indignantly replied 'only two or three millions!'"

A. CONTORTUS and ARISTIDA CŒRULESCENS are also very troublesome to sportsmen and others who have to walk through them, as they stick in their clothes and with their rough bristles cause considerable irritation to the skin.

30. A. VERTICILLATUS, Roxb. Fl. Ind. I. 263.

Culm erect, leafy, glabrous, 4—6 ft. high. Leaves 18 in. by ¾ in., hairy near the base; margin spinulous. Panicle erect, lax, 8—10 in. Branches numerous, verticelled, filiform, drooping. Pedicels of spikelets surrounded with brown or in some species with golden hairs; 2nd glume of fertile spikelet with a short thin awn; 4th glume with a larger and longer awn; 1st glume of the pedicellate spikelet awned.

The species with spikelets of a violet or yellowish colour and callus with golden hair is a lovely variety.

Habit.—Seen at Malabár Hill (Bombay) and in the Deccan.

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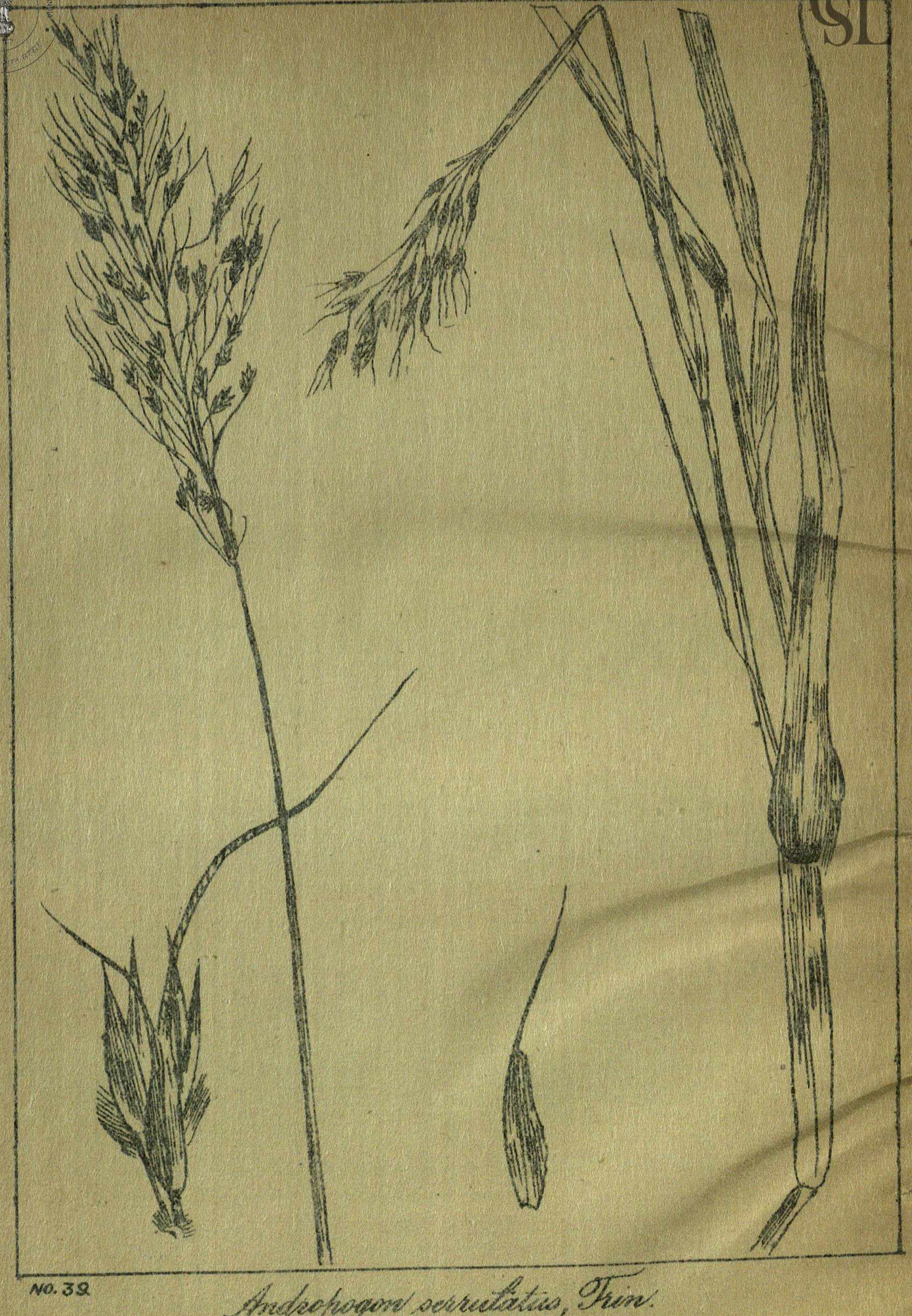

NO. 32

Andropogon serrulatus, Trin.

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31. A. MONTICOLA, Schult.

Vern.—*Tigori, Karni* (Duthie).

Culm 1—2 ft., sheaths glabrous or pilose. Leaves 1—2 in. Panicle with numerous capillary branches; the ultimate branchlets with 3 spikelets as in the genus; 2nd glume of the sessile spikelet shortly awned and ciliate; 4th glume with a perfect thick awn six or seven times its length. Of the pedicellate spikelet, 1st glume with or without an awn.

Habit.—Dhárwár, Mt. Aboo, and hilly parts of N. India. In Mt. Aboo it is reckoned as a good fodder grass, and the grain used as food by the natives.

32. A. SERRULATUS, Trin. Sp. Gram. t. 331.

Vern.—*Gogad, Ghoda* or *Ghora, Dand.*

Culm 2—4 ft. glabrous. Sheaths glabrous. Leaves linear, acuminate. Panicle ramous. 1st glume of the fertile spikelet 4-nerved, scabrous; 2nd glume bifid, ciliate with a short awn between the lobes; 4th with a long awn. 1st glume of the pedicellate spikelet 5—7-nerved, scabrous, with a thin awn or mutic. The pedicel and the base surrounded by brown or ferruginous hairs.

Habit.—A beautiful grass, specially when in flower, common throughout the Presidency; also in Nepal, tropical Himálaya, Kumaon, Ceylon, and Africa. Said to be good fodder, used much in Poona, but reports from other places unfavourable.

33. A. CARICOSUS, Linn.

Vern.—*Telia, Jetara, Chaoria, Patang, Marwel* (the last name common to more than one species of grass).

Stem decumbent at the base, glabrous. Leaves rigid, narrow acuminate, with a few tuberculated hairs towards the base. Spikes solitary or 2, 1 or 2 in. long, at the end of a very slender peduncle. Lower glume of sessile spikelet obovate obtuse, many nerved. The 2nd narrower, 3-nerved; 4th very narrow, ending in a long twisted or bent awn.

Habit.—Lanowli, Sháhapur, Khardi in Thána, Tápti valley. Kalyán; also in Central and N.-W. Provinces, Ceylon and China. Esteemed as good fooder. Eaten by cattle.

34. A. MOLLICOMUS, Kunth.; Dalz. and Gibs. Bomb. Fl. 301.

Vern.—*Ganya Marwel,* whilst the last species is called *Marwel.*

Culm 2—5 ft., the apex and nodes villous. Leaves 6—9 in. roughish. Spikes 2—4, terminal, 2—3 in. long; on densely pilose peduncles. Spikelets imbricate in 4 series. Fertile spikelet with long twisted awns; sterile mutic.

Habit.—Bombay, Násik, Poona, Surat, Jámner, Bhusával, where it is used as fodder. Also in Mauritius and Timor.

Hackel describes it as a variety of A. CARICOSUS.

35. A. ANNULATUS, Forsk.; A. BLADHII, R. I. 259.

Vern.—*Sheda*, *Sam*, *Payen*, *Palwan*.

Culm decumbent, ascending to 2—3 ft. or more. Nodes glabrous or hairy. Leaves 5—10 in. long, narrow. Spikes 3—6, almost sessile at the end of the peduncle. Lower glume of sessile spikelet many-nerved, obtuse, usually 3-toothed; 4th glume reduced to a twisted awn. Pedicellate spikelet with a mutic male flower or reduced to empty glume.

Habit.—Near Bhámburda, Poona, said to grow up to 5 ft. and is esteemed as good fooder fit for cutting, stacking and grazing. Grows generally on river banks and Mával hills. It is a common grass about Colombo, where it is considered to be an excellent fodder grass either in a green or dry state, and cattle are very fond of it. "Common all over the plains of N. India by road sides and in bushy places. It yields a considerable amount of fairly good fodder, which is largely made use of. Is very similar in habit to A. ISCHŒMUM and A. PERTUSUS, differing from the former by its blunt glumes, and from the latter by the absence of pit on the back of the lower glume. Specimens with the lower glume 3-dentate at the apex have hitherto been referred to A. BLADHII, Retz., but Prof. Hackel informs me that the true A. BLADHII is a Chinese variety of A. ANNULATUS, Duthie.

36. A. SCANDENS, Roxb. I. 258. A variety of A. ANNULATUS, Forsk.

Vern.—*Marwel* (name also of A. CARICOSUS).

Culm creeping and rooting from the lower nodes, or climbing over bushes, giving long roots, then ascending to 1—2 ft. Nodes and sheaths hairy. Spikes 3—6 nearly sessile at the end of the peduncle. Glumes hairy. Sessile spikelet hermaphrodite, awned and the pedicellate male or neuter.

Habit.—Common in the Deccan, where it is considered to be a good fodder. Roxburgh, however, says that cattle are not fond of it, as it is a coarse grass.

37. A. BLADHII, Retz. Obs. II. 27. A variety of A. ANNULATUS, Forsk.

Vern.—*Loari* in Beng.

Said to be a variety of the last species, from which it is distinguished by the spikelet being loose and more remote from one another, and the lower glume 3-dentate.

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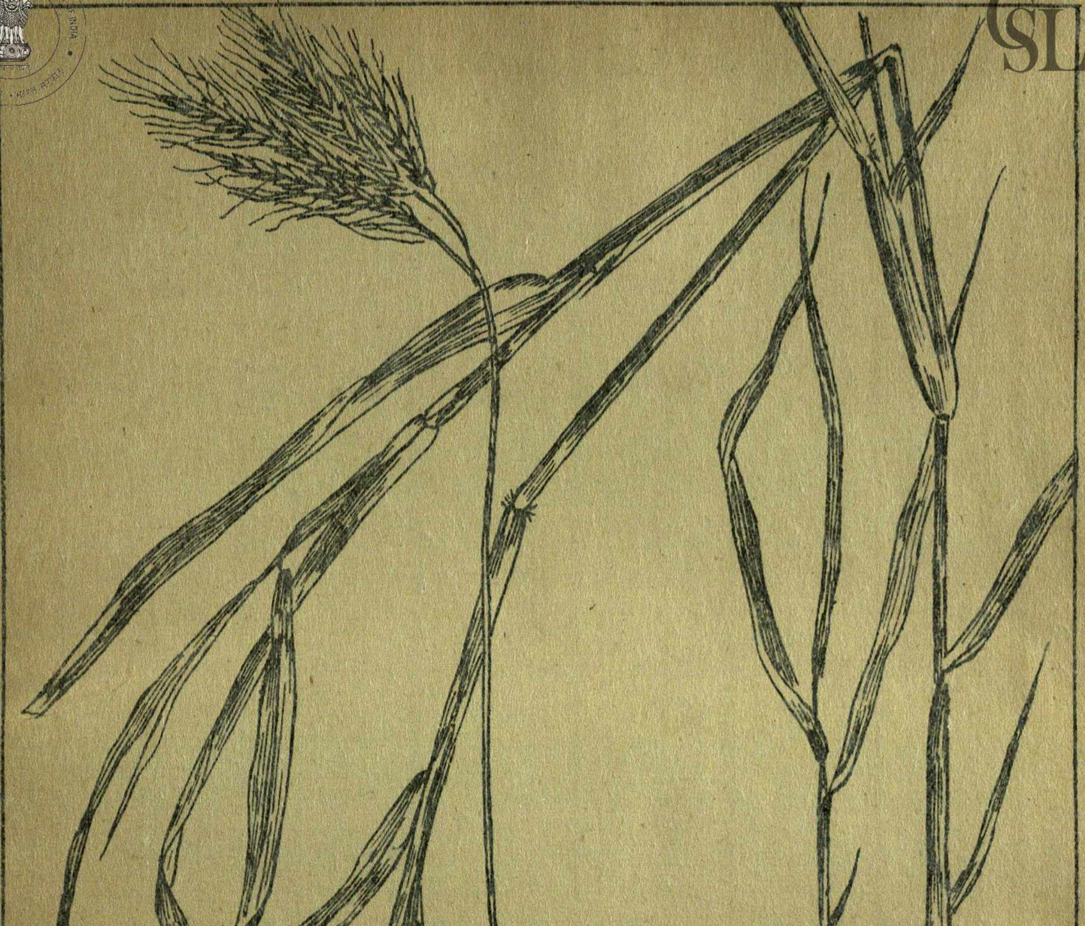

No. 40.

Andropogon annulatus, Forsk.

PAGE 82.

Habit.—Found all over the Presidency. Roxburgh says: "It is a native of hedges and road sides, but chiefly of old pasture grounds."

38. A. ARMATUS, Hook. fl.

Annual, tufted, erect, leaves linear copiously hairy, spikes **2**—5 subdigitate, long-peduncled, joints and pedicels slender not grooved, spikelets 10—20 pairs, 1st glume of sessile oblong obtuse sometimes alveolate dorsally densely silky below the middle keels ciliate, 4th glume a simple awn, 1st glume of pedicelled spikelets armed with spreading sub-marginal tubercle-based bristles twice or thrice its own length.

Stems 12—18 in. as thick as a sparrow's quill, simple or branched above; nodes bearded. Leaves 4—6 by $\frac{1}{6}$—$\frac{1}{4}$ in., flaccid, nerves slender, base rather contracted, softly hairy on both surfaces and with long tubercle-based bristles at the base; sheaths lax, upper smooth pale spathiform; ligule none. Spikes $\frac{1}{2}$—$1\frac{1}{2}$ in., flexuous, nodding or cernuous silvery-green, lowest pairs of spikelets male; peduncles $\frac{1}{6}$—$\frac{1}{3}$ in., capillary, axils with whorls of long white hairs; rachis and pedicels slender, terete, silkily ciliate, upper hairs long. Sessile spikelets $\frac{1}{8}$ in.; callus very short, silkily bearded; 1st glume thin, pale, nerveless, with often a large deep dorsal pit, margins narrowly incurved; 2nd glume acute, nerveless, dorsally silkily villous; 3rd glume oblong or linear, flat, hyaline, obtuse, nerveless; 4th glume with awn about 1 in., slender, nearly smooth, base acute. Pedicelled spikelets $\frac{1}{5}$ in., rather narrower than the sessile; 1st glume slightly convex, quite smooth between the bristles, keels ciliate, many nerved; 2nd glume ovate-oblong, 3-nerved, ciliate; 3rd oblong, obtuse ciliate; 4th very narrow.

Habit.—The Konkan (Stocks).

Subgenus XI.—HETEROPOGON.

Spikelets 1-flowered in pairs on the rachis of a solitary spike, terminal upon the culm or its branches. Spikelets imbricated, the sessile spikelets female, turned to one side of the spike or 1st to 5 or 15 pairs homogamous hermaphrodite awned; the awn hard, twisted; the awns of all spikelets are often entangled together. The pedicellate spikelets male and unawned.

Species 5 in the tropics.

A. CONTORTUS is cosmopolitan as far north as S. Europe N. America.

CSL

39. A. CONTORTUS, R. and S.

Vern.—*Suckali Koossal, Pandri-Suckali, Bal, Bale, Suckeri Musaneh, Suckal, Itali-suckal, Dakli-suckal* (small *Suckal* to distinguish it from the next large species), *Spear-grass* of the Europeans.

Culm 1—2 ft. Sheath flattened, hairy at the mouth. Leaves narrow with a few hairs. Male spikelets closely imbricate in 2 rows along one side of the spike. Female spikelets mostly confined to the upper part of the spike, surrounded by silky brown hairs.

This grass is very troublesome, the dry spikelets with their long twisted awns which fall easily, acting like barbed arrows. All the awns are twisted together like the strands of a rope. It is stated that the pointed callus of the glumes of this and of the other species bores into the flesh of sheep, and causes them injury, specially in Australia.

From reports received from all parts of the Bombay Presidency, it appears to be considered a good fodder grass, especially when it is young and green. In East Khándesh it is used as a thatching material. Mr. Duthie says: "In Rájputána and Bundelkund, where this grass abounds, it is cut and stacked after the rains are over. It is also cut for hay in the Hissarbir, and Mr. Coldstream states that it will keep good in stack for 12 years. On Mt. Aboo the people consider it the best fodder grass they have. In other districts it is said to be eaten only by buffaloes or by cattle when they are hungry and cannot obtain other kinds of grass. It is much used for thatching. The spears when the spikes are ripe, adhere in masses, and are called *sali* in Ajmere. In Australia it is looked upon as a splendid grass for a cattle run, as it produces a great amount of feed." In this Presidency it is not credited with such high properties.

Habit.—Common all over India, ascending up to 1,000 ft. on the Himálayas and Afghanistan. All over Africa (Central Africa, Serpa Pinto), Timor, China and Brazil.

40. A. TRITICEUS, R. Br.

Vern.—*Motti-kussal, Bale, Patang.*

Culm stout, glabrous, 4—5 ft. Sheath hairy at the mouth. Leaves 1—2 ft. by 3—4 lin., sparsely hairy. Spike thick, including the awns 8—12 in. long. Lower male or barren spikelets, $\frac{1}{2}$ in. long, yellowish green; the upper female, 3—4 lines long, contracted at the base, brown, on a short villous brown pedicel.

This species is easily known by the appearance of the spike, which is like that of the wheat.

Habit.—Throughout India, also in Burma, Ceylon, the Philippines, Java and Australia. Uses not known.

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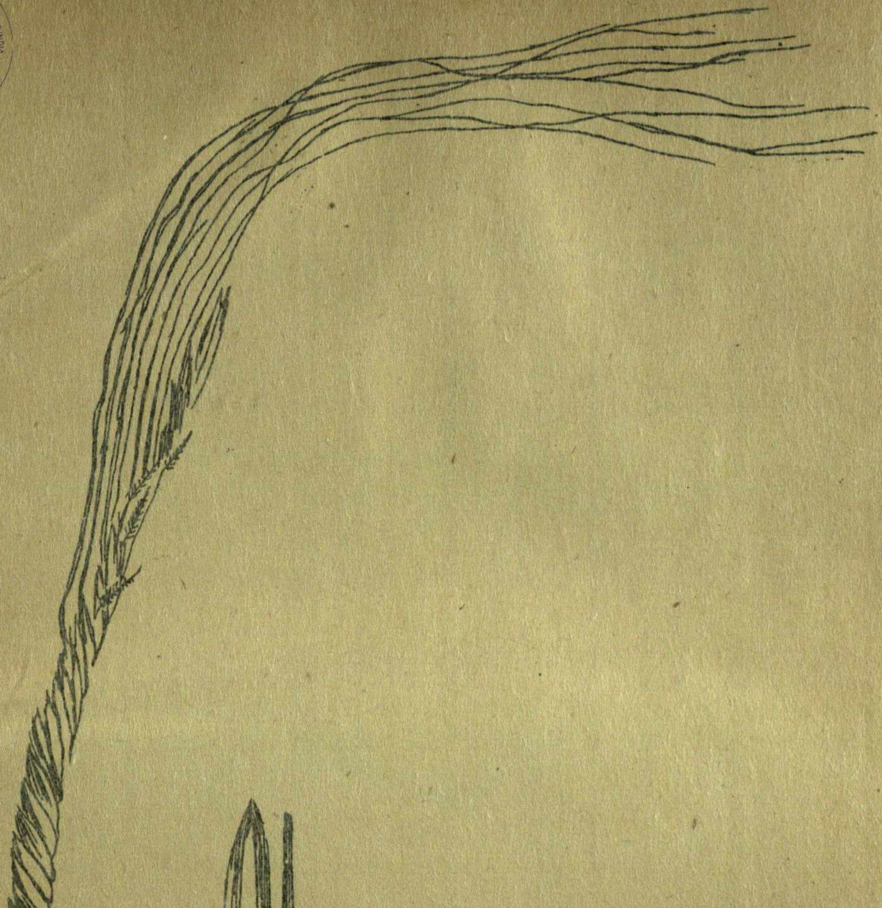

NO. 41

Andropogon contortus, R and S.

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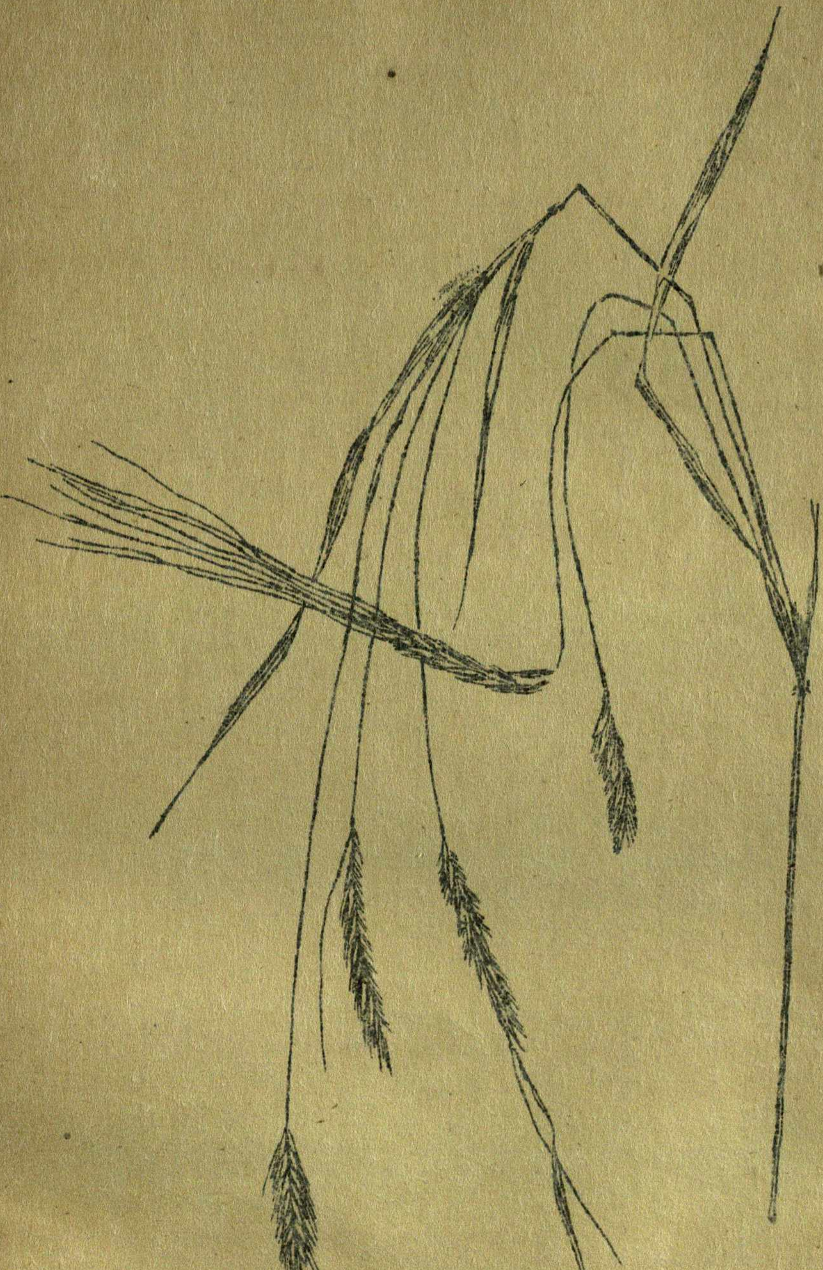

NO. 42.

Andropogon triticeus, R. Br.

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41. A. Ritchiei, Hook. f.

Leaves scabrid, ligule a row of stiff bristles connate below, spikes ⅔—1 in., green, hispid, sessile feminine, spikelets ⅕ in., callus short hirsute; 1st glume oblong, terete, rufous villous dorsally not channelled, nerves obscure; 4th glume has awn 1½—2 in., scabrid base acute, pedicelled spikelets 1¼—⅓ in., very shortly pedicelled green, 1st glume narrowly lanceolate acuminate many-nerved and with a marginal series of long spreading golden tubercle-based bristles.

Stem 4—6 ft. (one only seen), leaves 1 ft. by ⅓ in., coriaceous, linear from a narrow base, acuminate, flat, rigid, shortly hairy on both surfaces, hairs fine tubercle-based, margins spinulosely serrulate; sheath smooth; ligule membrous (?) spikes with peduncles shorter than the very narrow sheaths, stout, lower 1—2 pairs of spikelets, homogamous. Sessile feminine, spikelets softly villous. 1st glume not channelled dorsally; 2nd linear, 3-nerved, with a coriaceous hispid centre and membranous wings; 3rd smaller, hyaline nerveless; 4th glume with awn slender, tortuous, red-brown column pubescent. Pedicelled spikelets male, pedicels very short glabrous, 1st glume narrowly equally winged, glabrous, except for the bristles; 2nd glume lanceolate, 3-nerved; 4th glume oblong, hyaline. I have seen only the top of a branch with a single leaf of this remarkable species. The ligule is imperfect.

Habit.—The Deccan, Belgaum (Ritchie). Poona (Woodrow)

42. A. iwarancusa, Roxb. Fl. Ind. 276.

Vern.—*Iwarankusha, Ibarankusa, Kurankusa.*

Culm 2—6 ft., stout. Leaves narrow linear; margins hispid. Panicle ½—1 ft. long, dense, consisting of numerous fascicles of slender, pedicelled, thin spikelet; each fascicle surrounded at its base by a common boat-shaped bract, and many small ones chiefly at the base of the peduncle of each spikelet. Fertile spikelet surrounded at its origin by white hairs. Awn very thin, erect or slightly twisted.

Dalzell and Gibson state: "The whole plant is aromatic. It is particularly mentioned by Arian in his account of Alexander's journey through the Punjáb and Sind, and was gathered by the Phœnician followers of the army in Lus, who called it *spikenard.* It is common about Karáchi, and is used as scent by the natives. It may be found in the Ahmedabad Zilla, but we think there is some mistake as to its having been found in the moist Konkan as stated in Graham's Catalogue."

Habit.—Grows also on the plains at the foot of the Himálayas, Hurdwár, Nepal, Sennar and Abyssinia.

CSL

43. A. LANIGER, Desf.. A variety of A. IWARANCUSA.

Vern.—*Iaramkush, Karamkush, Azkir, Kavi, Gandel, Runa, Dalsulo, Khair.*

Culm ½—2 ft., woolly. Leaves glaucous, stiff. Panicle oblong, narrow, branched; branches sheathed at the base by a boat-shaped spathe. Rachis and pedicels of the awnless male spikelets densely clothed with white hairs. Flowering glume of hermaphrodite flower transparent, bidentate and with an imperfect or very slender awn.

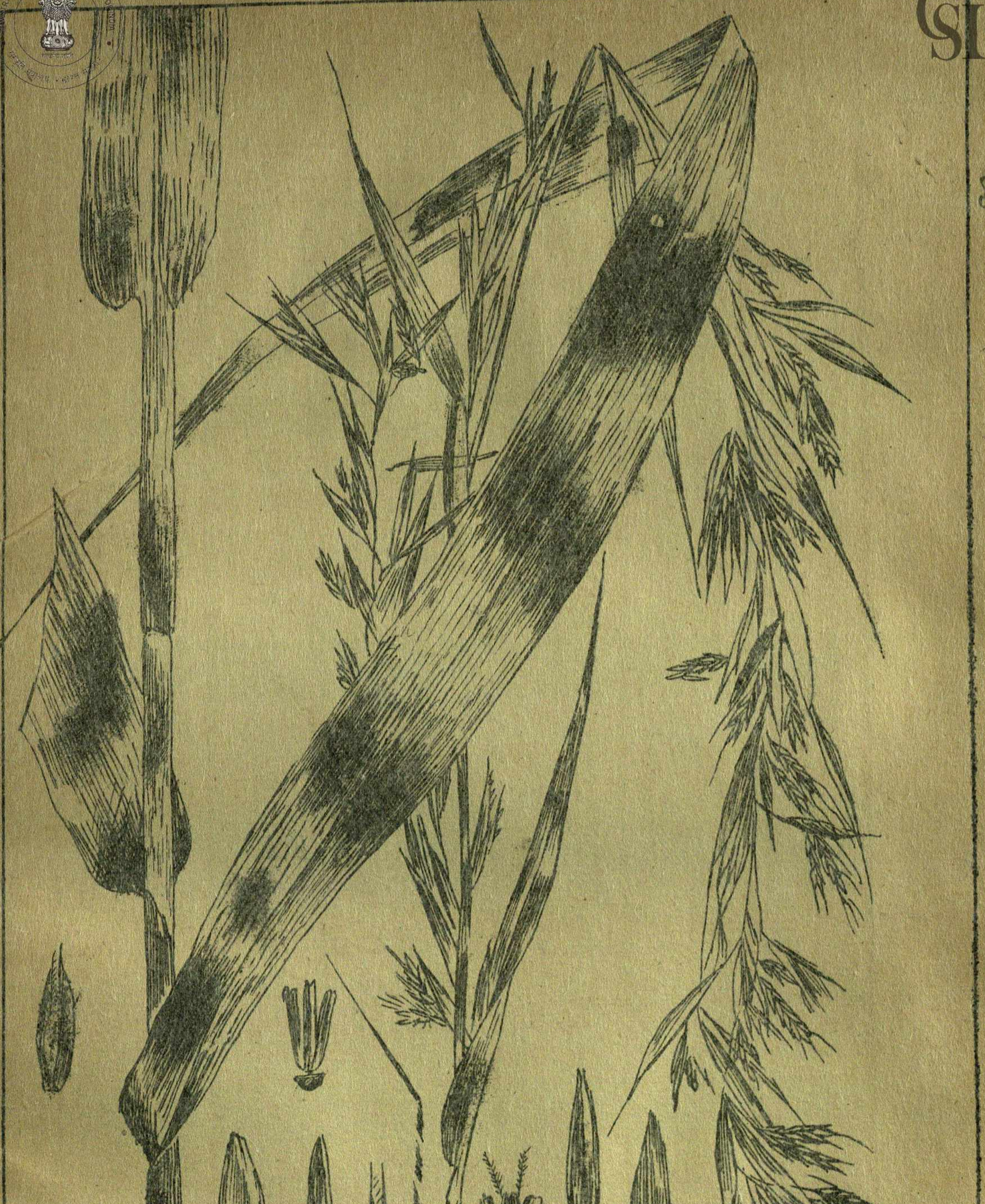
Habit.—It is a sweet-scented grass, rare in this Presidency; grows in Sind, Baroda, N. Kánara and the Deccan. Also in the Punjáb, Rájputána and N.-W. Provinces; in all mountainous places such as Afghanistan, West Himálayas, Tibet, Persia, Arabia and Morocco. It is not esteemed as good fodder, eaten only when young and green by cattle to whose milk it imparts its odour. Roots are sometimes used like *kaskas* in the manufacture of tatties.

44. A. SCHŒNANTHUS, Linn.; A. MARTINI, Roxb. Fl. Ind. I. 277.

Vern.—*Rosa, Rosha, Rose, Ginger grass* of Europeans.

Erect, 3—6 ft. Ligula ovate, scarious. Leaves from an amplexicaul base, linear, 1 ft. or more glabrous. Panicle narrow, 1—1½ ft., much branched, with bracts under each branch. Peduncles solitary within the common bract, each bearing a small adpressed bract, and 2 few-flowered spikes. Rachis and pedicels solitary, strigose with short hairs. Flowering glume of the sessile spikelet bifid with a fine awn, double the length of the spikelet. Pedicellate spikelet reduced to empty glumes.

Habit.—Very common all over India, Australia, Ceylon, China, Macao and Africa. In this Presidency it ascends as high as Panchgani, rare on the top of Mahábaleshvar. Of all the scented ANDROPOGONS, this is the best known, and an aromatic oil, called *Rosha oil*, is distilled from it in Khándesh. Cattle eat it, especially when young, the scent of which is said to be imparted to the milk. The dry grass is used by natives for thatching the roofs of their huts, and occasionally for making tatties. It appears from the Bombay Gazetteer, Vol. XII, that in Khándesh people distinguish two varieties, one with bluish and the other with white flowers. The oil produced from the first is of a green colour and is called *Sophia;* that from the other is white, and is called *Motia* It is stated by Mrs. Lisboa in her paper read at the Bom. Nat. Hist. Society's Meeting held on 7th August 1889, that the same plant bears inflorescence bluish, white and



NO. 43

Andropogen schœnanthus, Linn.

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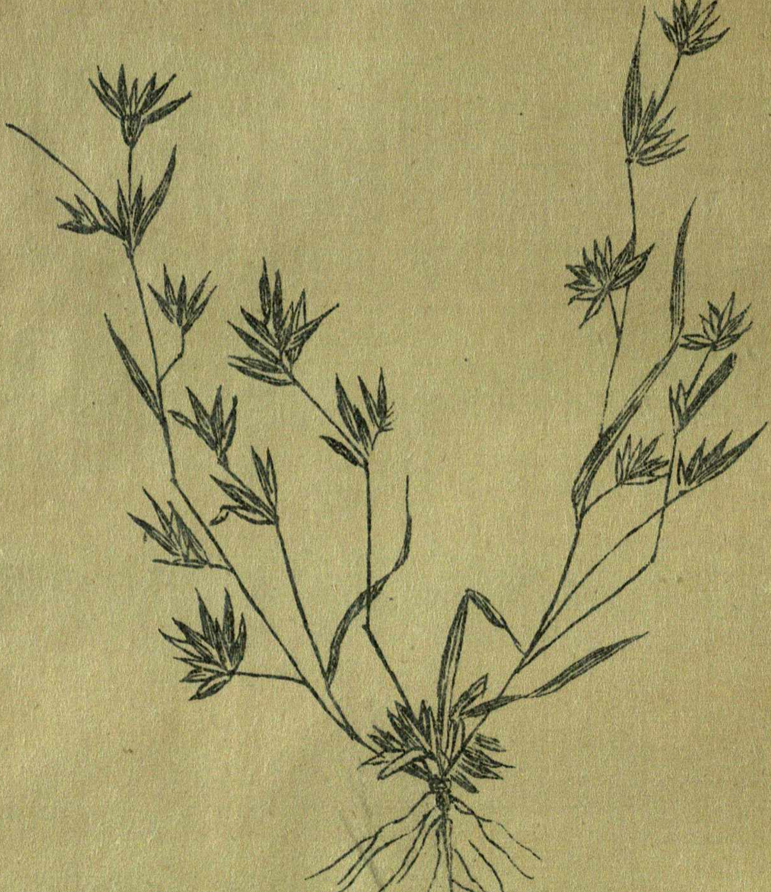

NO. 44.

Iseilema wightii, Anders.

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red at different stages of its growth, and that the colour and density of its oil may vary according to the process of distillation employed or according to the age at which the plant is cut and used. Dr. Dymock says that a large quantity (above 40,000 lbs.) of the *Rosha oil* is annually exported from Bombay to the Red Sea Ports and to Europe. It is much used by Arabs and Turks as a hair oil, and by the natives of this country in rheumatism. But the most remarkable use made of this oil is that of adulterating *attar* of roses in European Turkey. The Bombay dealers know nothing of its being thus employed to adulterate *attar* of roses. In India sandal-wood oil is used for the purpose. See Dr. Dymock's "Vegetable Materia Medica," and Mrs. Lisbca's paper above alluded to.

The description of the following Andropogons is copied from Hooker :—

45. A. DISTANS, Steud. Syn. I. 387.

Culm slender. Leaves 6—8 in., narrow, glabrous. Panicle about 1 ft. long, consisting of a few distant, reflexed spikelets or 2 in each axil surrounded by a common bract. Rachis and articulations hairy. Lower glume of the sessile spikelet 3—6 or more nerved. Awn more than double the length of the spikelets. Male flower mutic.

Habit.—In various parts of India, rare. Received specimens from N. Kánara and from the confines of Bombay, towards Madras and from Raichore.

46. A. CITRATUS.—This grass called *Oli Cha* or *Nili* or *Lili Cha* (green tea), *Agya-ghas, Aginghas,* yields lemon grass oil or oil of verbena of commerce.

Habit.—It is found in the cultivated state, and as it bears a close resemblance to A. NARDUS, Linn., it is probably one of its varieties. Mr. Hackel says : "*A. citratus D.* (Cat. Hort. Monp. 78) *sine disc iptione florum, aut ad A. nardum aut A. Schœnanthum pertinet.*"

43. ISEILEMA, Anders.

Panicle small, cyme-like as in APLUDA, composed of numerous racemes, each solitary at the end of branches, and subtended by a bract, enclosing below 4 male involucral spikelets in 2 pairs, barbed at the base, and above a triplet, 2 pedicellate male and 1-sessile fertile awned spikelet.

1. I. WIGHTII, Anders.; ANTHISTIRIA CIMICINA, Edgew. As. Journ. 1852, p. 182.

CSL

Vern.—*Sona, Achi-grass, Tambrut, Tambit, Gondwal, Ganni, Mussan.*

Culm $\frac{1}{2}$—2 ft. diffuse or quite prostrate. Sheaths glabrous or with a few hairs, verrucose at the keel. Leaves 2—4 in. long, glaucous, and in time rufous. Panicles slender, interrupted, decomposed into numerous filiform branches. Peduncle of spikelet verrucose towards the apex.

Habit.—It yields a disagreeable smell. Grows all over the Presidency; specimens received from E. Khándesh, Poona, Sátára, Sholápur, Konkan and Kánara; also from N. India. "In Bundelkhand and Central Provinces is frequently the prevailing grass on the black soil, its reddish-coloured stem rendering it a conspicuous object from a considerable distance."—Duthie.

2. I. LAXUM, Hack.; ANDROPOG, 682.

Vern.—*Shata, Gandwel, Tambit, Tambrut, Gandhi, Chamge Gandil, Dangers, Masel.*

Culm prostrate or ascending 1—2$\frac{1}{2}$ ft.; sheaths glabrous, not verrucose. Leaves 1—3 in. long ciliate at the base. Panicle long slender; bracts equal to or longer than the racemes, glabrous, membranous, reddish at the margins. Pedicels with tuft of hairs at the base. Fertile spikelet with a long slender and slightly twisted awn.

44. PSEUDANTHISTIRIA.

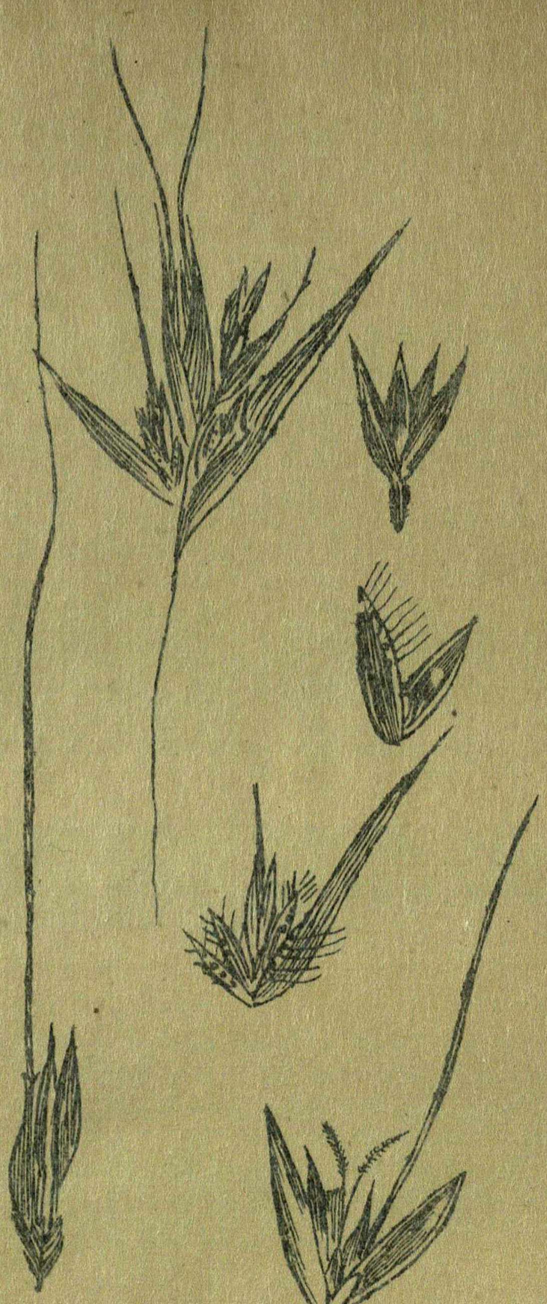
Annual grasses, with the habit of Anthistiria, but wanting the involucrant spikelets of that genus.—Hooker.

1. P. HETEROCLITA, Hook. f.

Culm slender, 1—2 ft. glabrous. Sheaths glabrous. Leaves scabrous with bulbous-based hairs. Panicle rather dense, divided into numerous filiform branches, the ultimate branchlets bearing bracteated racemes, consisting of 2 fertile and 3 neuter spikelets. Fertile spikelet sessile, hairy at the base. 3rd glume none; 4th a thin awn. Pedicellate spikelet neuter; 3rd and 4th glumes none.

Habit.—Received specimens collected at Kasarsai, Poona, where it is said to be common on hilly ground. Chiefly used for thatching. Grows also in Calcutta, Mangalore, China, Africa and Australia.

2. P. HISPIDA, Hook f. Flora B. India Vol. VII, page 219. Konkan. Stocks. Law. Poona, Woodrow.



NO. 46

Anthistiria ciliata, Linn.

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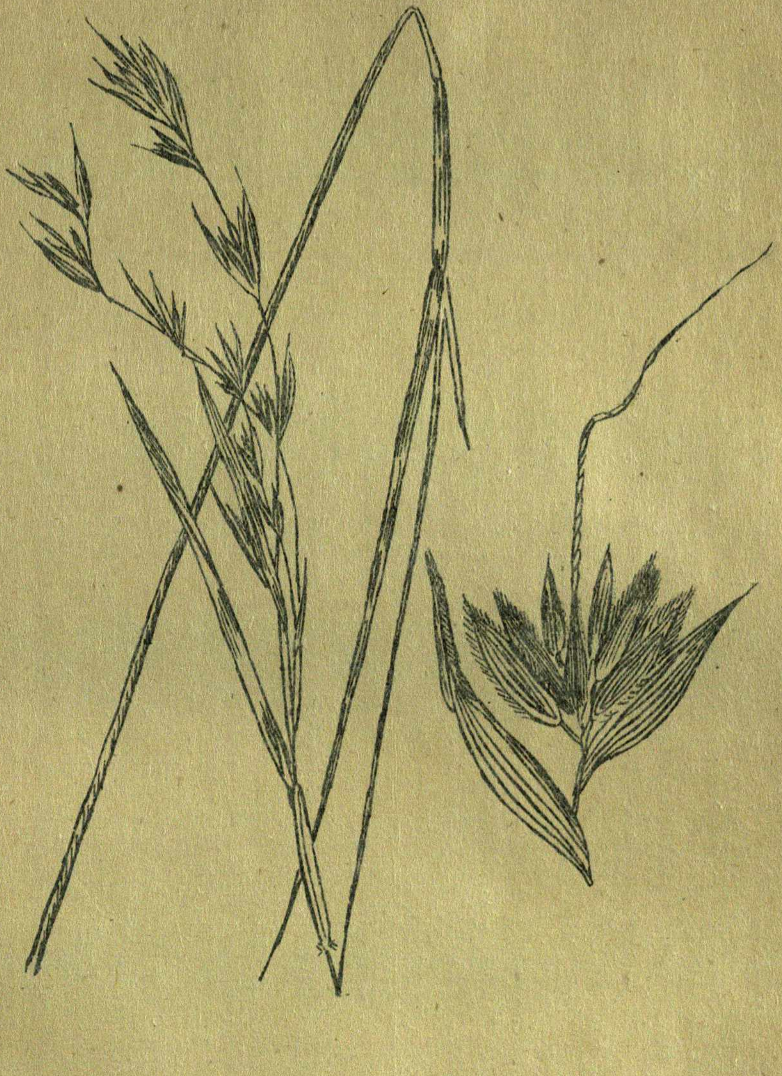

NO. 45

Iseilema laxum, Hack

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45. ANTHISTIRIA, Linn. f.

Racemes spike-like, solitary at the end of branches, each composed of several spikelets, 4 lower in 2 pairs, neuter or male and mutic, arranged in the form of an involucre, surrounding 3 inner or upper spikelets, the central sessile and fertile, usually awned, the 2 latteral shortly pedicelled and similar to the 2 outer pairs. Occasionally there are 1 or more extra pairs of spikelets.

One species with many varieties, awned, or unawned, spread throughout India (common), China, and Australia.

1. A. CILIATA, Retz. Obs. iii, 2. THEMEDA FORSKALII, var. VULGARIS, of Hackel.

Vern.—*Batani, Bunden, Bungrat, Marar, Musani, Bhoru, Karad.*

Culm 1—4 ft., often red, thick and stout, rooting at the base. Upper sheaths with hairs tuberculated at the base. Leaves narrow, ciliate at the base. Panicle composed of rather remote branches. Bracts longer than the racemes, cuspidate, becoming rufous or red. Glume hard, obtuse, hairy. Lower spikelets 6, all neuter; fertile spikelets bearded at the base.

Habit.—Grows everywhere and is used as good fodder. This and the last species form the greater part of the best specimens of hay in this country.

2. A. CILIATA, Linn. f. Nov. Gram; THEMEDA CILIATA, Hack.; A. SCANDENS, Roxb. Fl. Ind.

Culm erect, 3—6 ft. high; branching and rooting from the joints; leaves linear, glabrous, $\frac{1}{2}$—$\frac{3}{4}$ ft. long. Lower sheaths glabrous, upper tuberculated or hairy. Spikelets in a long nodding panicle, each cluster subtended by a membranous, boat-shaped bract an inch or more long with a long point. Summit of glumes of 4 outer spikelets beset with hairs seated on tubercles, 4th glume of the central fertile spikelets long awned.

Habit.—Grows at Lanowli, Khandála, Ghâts, Konkan, Malabár, Bengal, Nepal, Himálaya and Mauritius.

3. A. TREMULA, Steud. Syn. Pl. Glum. I. 401.

Vern.—*Bhatandi, Bungrat* (Poona name), *Barki, Gundi.*

Culm 1—2 ft. or more, glabrous. Sheaths with hairs at the margins. Leaves 4 in. to $1\frac{1}{2}$ ft. long, scabrous. Panicles drooping. Bracts oblong, lanceolate, glabrous, or tuberculato-pilose, nearly equal to the racemes. Lower or outer spikelet male usually 3-

glumed. Fertile spikelet clothed at the base with brownish hairs, awned.

Habit.—Grows over Ghâts; specimens received from N. Kánara and from various other districts. Said to be good fodder.

4. A. CYMBARIA, Roxb. Fl. Ind. I. 251; Dalz. and Gibs. Bomb .Fl. 304.

Vern.—*Karar, Ful-gavat.*

Culm erect, 3—6 ft., solid. Sheaths barbed at the mouth Leaves 1 ft. or more, glabrous, or hairy at the base. Panicle of numerous bracted branches. Bracts boat-shaped, subulate acuminate, or long-pointed, rufous, glabrous, or sometimes with long rigid hairs at the margins. Spikelets 7, 4 lower male in 2 pairs, surrounding the inner 3.

Habit.—A coarse grass, very common, grows all over the Presidency. Cattle eat it, and hay is made of it. Much used in Bombay.

Series B.—POACEÆ.

Pedicels continuous below the glume. Rachilla often articulated above the lower persistent glume or wholly continuous and sometimes produced above the fertile florets in the form of a stipe-bearing male or rudimentary flowers.

Tribe VII.—AGROSTIDEÆ.

Spikelets 1-flowered, usually all hermaphrodite. Rachilla articulate above the lower empty glumes, often produced above the flower. Flowering glume with or without an awn; empty glume as long as, or longer than the flowering glume. Palea thin and transparent. Grain not sulcate.

46. ARISTIDA, Linn.

Spikelets 1-flowered, cylindrical, pedicellate. Glumes 3, narrow; 2 lower empty, usually longer than the flowering glume, pointed. Flowering glume rolled round the flower with a terminal trifid, or 3-branched awn; lateral branches often shorter. Grain narrow enclosed in the flowering glume.

Species about 100, chiefly in warm dry sandy regions, numerous in N. America.

The species belonging to this genus are easily made out by the 3 long (the central longer) awns proceeding from the flowering glume. They are divided into 3 sections—

1. CHŒTARIA.—The flowering glume is continuous with the awn without any articulations; hence awns not deciduous.

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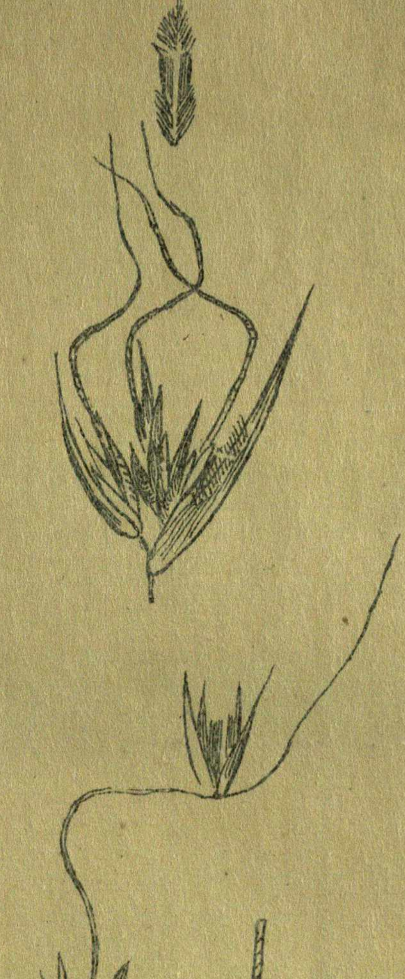

No. 47

Anthistiria cymbaria, Roxb.

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GSL

See Trin. Sp. Gram. 113, Beauv. t. 8, fig. 5—6. Lateral branches of some species very small and deficient.

2. ARTHRATHERÆ.—Awn articulate with the glume, twisted below the branches, deciduous. Flowering glume much shorter than the empty ones—Beauv. t. 8, fig. 8.

3. STIPÁGROSTES.—All awns (or the central only) plumose, twisted below the branches, deciduous—Beauv. t. 8, fig. 10; Vahl. Symb. 3; Jaub. and Spach. Ill. Pl. Or. t. 334 and 388.

1. A. ADSCENSCIONIS, Linn.

Vern.—*Motti-burri*, *Longi-kussal*, *Lani*.

Culm procumbent or ascending 6—18 in. or more wiry. Leaves rather glaucous, narrow, subulate. Panicle 3—5 in. sometimes interrupted at the base. Branches rather contracted and nodding.

Habit.—Common all over the Presidency, especially in dry places, widely spread over tropical and sub-tropical Asia and Africa, and the South Mediterranean region and in Australia. Cattle do not eat it. Some reports from Gujarát and Poona say that it is of little value as fodder grass, others state that it is eaten when young. Stewart describes it as a favourite fodder for cattle in the Punjáb. Symond says that it is a troublesome grass, which cattle will not eat. Coldstream states that it is grazed (when young), but is too short and light to stack, that it covers the Hissar bir in vast sheets, is too fine to cut with a scythe, but is nutritious and particularly relished by cattle. This opinion is not borne out by reports from other parts of India.

2. A. SETACEA, Retz. Obs. IV. 22.

Vern.—*Mothi-Kussal*.

Culm erect, firm, 2 ft., tumid at the nodes. Leaves filiform, convolute, flaccid, 3—6 in. Panicle contracted, of a straw colour, Branches solitary or several. Glume very acute, upper much longer. Awn longer than the flowering glume.

Taller than the last two species. Found growing in various parts of the Bombay Presidency, in Ceylon, Africa, Brazil, in Southern Spain and Sicily. The culms are turgid at the nodes. Leaves filiform, convolute, 3—6 in. long. Panicle rather dense, of a straw colour. Glumes unequal, and the awns very long and spreading.

Habit.—Like the preceding, common on dry hilly ground. As fodder it is useless. Cattle do not eat it. Tatties and brooms are said to be made of its long wiry culms. It is most troublesome to those who have to walk through it, the ripe spikelets fall off, acting as irritating substances.

Probably a variety of A. DEPRESSA ?

3. A. HYSTRIX, Linn. f.

Vern.—*Pawn-burri*, *Matari-Kussal* (old woman's hair), *Kale-Kussal.*

Culm 1—2 ft., more rigid than the last. Leaves 3—6 in., glaucous. Panicle ½ ft. long, rigid; branches angular, spreading, bearded at the axil.

It is a more rigid grass than the preceding, and with a broader and more open panicle. It is common in dry and stony places, and not much used as a fodder grass. In this respect it may be ranked as the last, *i. e.*, it is eaten only when young.

4. A. FUNICULATA, Trin. and Rupr.

Vern.—*Pandhri* or *Pandri-Kussal*, *Bushi-Kussal.*

Culm 8—11 in., occasionally taller. Sheaths longer than the internodes. Leaves short, flat, glaucous. Glumes 6—7 lines, acuminate, subulate, whitish, nearly equal. Awns very long, 1½—2 in.

Habit.—Throughout India. In some parts of Poona, Sátára, Sholápur and Bhúj. It is so common that the places where it grows in extensive patches appear to be of a dull grey or glaucous colour. Not used as fodder.

5. A. REDACTA, Staff. Nov. Sp. Culm slender, erect or slightly bent at the base, 2 ft. high, glabrous, or hispid. Sheath shorter than the internodes, glabrous, rather striated. Ligula very short, truncated ? Nodes glabrous. Leaves 5—7 in. long, filiform, rigid, convoluted, glabrous. Panicle 6—12 in. long, diffuse, rachis hispid or scabrous, owing to minute murication turned upwards. Branches erect or nodding, capillary, flaccid, 2—3 in. long, generally 2 together, one a little longer than the other, often arising from a common very short (about ½ lin.), rather thick peduncle, which is soon divided into 2 branches. Each of these is dichotomously subdivided into filiform branchlets, the latter bearing towards the upper part 2—3 spikelets, supported on pedicels 2—5 lines long. The internodes or spaces between the origin of branches are about ¾—1 in. Spikelets 4—5 in. long. 1st glume pointed, 4—4½ lines long, including the awn-like point; mid-rib prominent, with muricated or stiff hairs turned upwards. 2nd glume nearly equal, 2-toothed or jagged. Flowering glume folded over the flower, 3 lines long, ending in three awns; the central twisted and bent, 13 lin. long, the bent portion about 9

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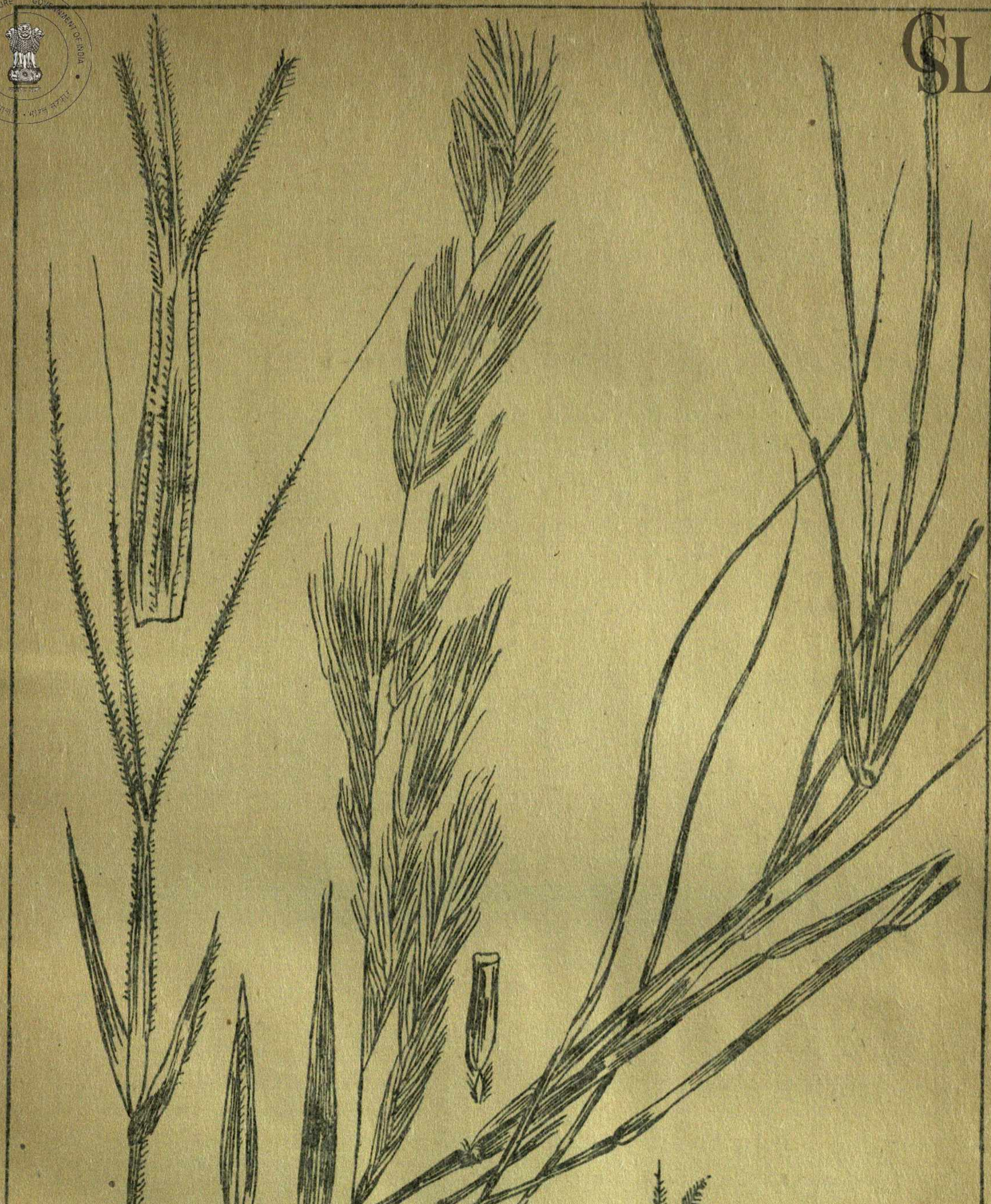

NO. 48.

Aristida redacta, Stapf.

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lines long; the lateral awns straight, not twisted, about 5 lin., terminating a little above the bent portion of the middle awn. The rachis between the lower and flowering glumes is about ½ line long, surrounded with numerous white hairs. Stamens 3, Styles 2. Palea minute, 2-ribbed, pointed. Caryopsis small, almost rounded.

This elegant grass appears to resemble a species of ARISTIDA, but its natural place is in STIPA. It is common in the Deccan; also in Burdwán. Used in ornamenting bouquets.

47. **HELEOCHLOA.**

Rigid annual or perennial erect or prostrate grasses. *Leaves* flat or convolute. Spikelets 1-flowered, densely imbricate in cylindric spikes or speciform panicles, laterally compressed; rachilla not produced above the 3rd glume. Glumes 3, hyaline. 1st and 2nd subequal or the 1st shorter, keeled, 1-nerved, persistent; 3rd=2nd or longer, lanceolate or oblong, 1-nerved; palea oblong, obtuse or 2-fid, 2-nerved, lodicules 2 (or 0?). Stamens 2 or 3. Styles elongate. Grain ovoid, loose in the glume and palea.—Species few, oriental. (Flora of B. India.)

1. H. SCHOENIDES, Host.

Annual, stems compressed. Spreading in a circle from the root, panicle ovoid-oblong sessile on the greatly dilated sheath of the uppermost leaf.

Habit.—Sind, near Karáchi.

2. H. DURA, Boiss.

Perennial, minutely pubescent, stem stout ascending, leaves involute pungent, panicle elongate cylindric narrow.

Habit.—Sind. Stochs. In salt water. Sea-shore, Dwárka. Bot. Survey, Bombay.

48. **WOODROVIA.**

A new genus proposed by Dr. Stapff for the following species. See Hook. Icon. 2447.

Spikelets 1-flowered, solitary, inserted on the inarticulate branches of a more or less loose terminal panicle. Flower hermaphrodite, articulate with pedicel and of 3 glumes compressed on the sides; 2 outer glumes are empty more or less thickened or keeled on the dorsum, faintly 1-nerved, or the 1st faintly 3-nerved below the apex; 2nd glume narrower, the flowering glume 1-nerved by a line, 2-lobed; awn twisted, geniculate, arises from between

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the nodes. Stamens 2. Styles distinct; stigmas, plumes laterally protruded. Caryopsis cylindric included in the glumes, free.

1. W. DIANDRA, Stapf. (Sp. unica).

Culm slender, $1\frac{1}{2}$—2 ft. high. Nodes hairy. Sheaths glabrous or the inferior hirsute. Leaves 3—4 in. by 1—2 lin., setaceo-acuminate, the superior much reduced or none. Ligula short, truncate, ciliolate. Panicle 2 in. long. Spikelets green or violet in colour, 3 lin. long. 1st glume more or less pilose on the dorsum, and ciliolate at the margins; 2nd glume densely ciliolate. Caryopsis yellowish.

Habit.—Deccan and Northern India.

49. GARNOTIA.

Erect, perennial, rarely annual grasses. *Leaves* flat or convolute. Spikelets very small, 1-flowered, panicled, solitary or geminate, jointed on the pedicels, narrowly lanceolate; rachilla not produced beyond the flowering glume. Glumes 3, 1st and 2nd empty, subequal, 3-nerved, acuminate, equalling or longer than 3rd, awned or not; 3rd bisexual, 1-3 nerved, triandrous, very narrow, terete, tip acuminate or notched, awned, rarely awnless or 3-awned; awn straight or base twisted, rarely geniculate or recurved; sides of palea auricled at the base. Lodicules 2. Styles free. Grain linear or oblong, free.—Species about 20, Asiatic and Polynesian. (Hooker's Flora of B. India.)

1. G. SCOPARIA, Stapf.

Stem 3 feet. Leaves very narrow, plicate or keeled. Panicle 16—20 in. long. Narrow branches very long, spikelets $\frac{1}{6}$ in., base shortly bearded, glumes firm, 2nd 3-nerved, awn of 3rd about as long as the spikelet, base twisted.

Habit.—On roofs at Kalyán (Woodrow).

50. POLYPOGON, Desf.

Spikelets 1-flowered in a contracted or spike-like panicle, often interrupted, the pedicel articulate. Empty glumes 2, frequently bifid with slender, straight, rather long awns. The flowering glume thinner, smaller, entire or notched with a twisted or straight awn, sometimes reduced to a point; grain enclosed in the glume and palea, but free from them. The numerous awns impart a bristly appearance.

Species 10, widely distributed over the globe.

1. P. MONSPELIENSIS, Desf.; Kunth. Enum. I. 232; Steud. Syn. Pl. Glum., I. 184; Beauv. Agrost. XVI. fig. 8.

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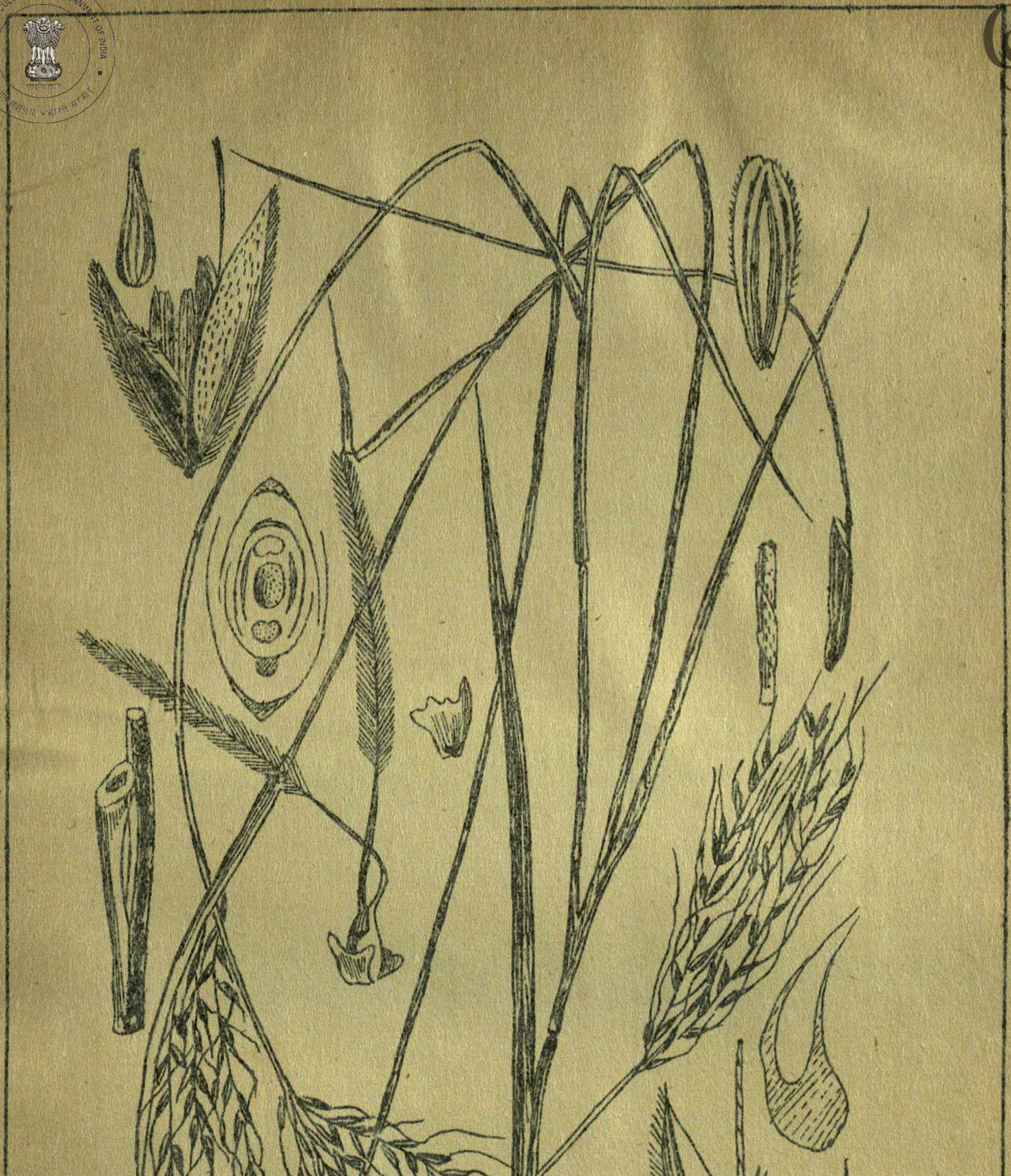

No. 49.

Woodrovia diandra, Stapf.

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Vern.—*Chitra, Malhár.*

Culm procumbent at the base, then erect or ascending, simple or sometimes branched, 1—2 ft., glabrous. Sheath glabrous, striated. Ligula rather large, 2—3 lines, obtuse. Leaves glabrous, or scabrous, 5—8 in. long, 2—3 lines broad. Panicle spike-like, linear, cylindrical, dense, 1—3 in. long, of a yellowish-green or whitish colour. Spikelets not longer than a line. Lower glumes nearly equal, scarcely 1 line long, pubescent or ciliate, with minute murication on the midrib, obtuse or notched, ending in a fine, straight awn, 3 or 4 times as long as the glume. Flowering glume broad, hyaline truncate, 4-toothed or jagged, the awn usually very short or wanting.

Habit.—Common in Europe, Asia and Africa, also in Ceylon and Australia and in some parts of America, where it is supposed to be introduced. Mr. Duthie states that it is common in cultivated ground. It is an ornamental grass, but of little value for fodder. I have received specimens from Sind.

51. SPOROBOLUS, R. Br. Vilfa, Beauv.

Spikelet 1-flowered, minute, awnless, in lax, rarely in dense panicles. Lower 2 glumes empty, equal or unequal, usually shorter, never longer than the flowering glume. Palea nearly as long, usually 2-nerved. Grain free, within a loose crustaceous pericarp.

Species about 80, chiefly in the tropical and temperate regions of America, but also in the warmer regions of Asia and Africa.

1. S. DIANDER, Beauv.

Vern.—*Chireya-ka-dana.* In Bengal it is called *Bena-goni.* Roxb.

An erect, glabrous grass 1½—3 ft. high. Culm slender; nodes glabrous. Sheath slightly bearded at the mouth, shorter than the internodes. Ligula very short, ciliated. Leaves chiefly at the base of the culm, very narrow and tapering to a fine point. Panicle contracted, 6 in. long, often longer, usually bending over a little. Inferior branches about 1 in. long. Spikelets 1 lin. long, rather acute, glabrous. Lower empty glumes very obtuse, the lowest very short. Flowering glume longer. Palea broad, obtuse, not so readily splitting as in other species. Grain obovoid, not easily separable from the pericarp.

Habit.—Not common; said to be common in the plains of the North-West Provinces and at moderate elevations on the Himálayas; in fact it is widely spread in India. It grows also in Australia, and

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is said to be very common about Colombo. Reported from Poona to be a good fodder grass fit for grazing. Said to be readily eaten by horses and cattle at Láhore, and is also favourably mentioned at Gujranválla and Shápur. Mr. Fergusson says that cattle in Ceylon do not like this and the last described species.

2. S. Indicus, R. Br. Prodr, 110.

Vern.—*Ghorla, Khir.*

Culm slender, 1—1$\frac{1}{2}$ ft., glabrous. Sheaths glabrous, with a few hairs at the margins, or at the mouth only. Leaves also glabrous, mostly at the base of the stem, linear, ending in fine points. Panicle spike-like, contracted, 3—8 in. long, sometimes longer, often interrupted. Spikelets numerous, crowded along the short, erect, appressed distant branches. The outer glume obtuse, $\frac{1}{2}$ line long; 2nd glume $\frac{3}{4}$ line long. The 3rd or flowering glume 1 line long. Seed obovoid.

It grows all over India, the Himálaya, North-West Provinces, Ceylon, Australia, and is generally spread over the tropical and sub-tropical parts of the world. Considered to be a good fodder grass. At Bálághát it grows on clayey soil, and is used as fodder when young. In the Gujranválla district (Punjáb), it is reckoned as good fodder, especially for horses. In Australia, it is valued as an excellent pasture grass. It stands drought well, and is generally eaten by stock. (See Duthie.) In the United States this grass, which is known there under the name of *smuth* grass, is of considerable value for grazing purposes, if frequently cut or grazed down, but if allowed to remain untouched long, cattle and horses, unless very hungry, will not eat it, as it becomes tough and unpalatable. Mr. J. N. Brashear, of Port Gibson, quoted by Dr. Vasey, remarks in reference to this species: "It is common all over our pasture lands, and is very hardy, standing any sort of weather. It grows well on almost any kind of land, but does best on rich moist bottoms. It is not used to any considerable extent for hay, but it makes splendid feed, if cut while young. It will yield about 1$\frac{1}{2}$ tons per acre...... It makes a splendid pasture plant, and that is generally what we use it for. Stock are generally fond of it, until it goes to seed, and they sometimes use it when dry in winter." It is a common grass in the Kandian country, Ceylon.

3. G. glaucifolius, Hochst.

Slender. Glaucous, leaves short, strict, narrow, flat or undulate. Glaucous not pungent, panicle elongate contracted, white branches very short erect, spikelets $\frac{1}{16}$ in. subsessile crowded. 1st and 2nd glumes subequal ovate-lanceolate acuminate as long as the 3rd or rather longer.

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Habit.—Near Bombay on sandy salt land (Woodrow).

4. S. ORIENTALIS, Kunth. Enum. I. 211; Dalz. and Gibs. 295, Bomb. Fl.

Vern.—*Shapia, Kal, Usar-ki-ghás.*

The whole plant glabrous, culms extensively creeping, ramous, with 4—8 in. of the extremity erect, smooth, filiform and very firm. Ligula short, ciliated. Leaves chiefly at the base of the stem, very short and smooth, tapering to a fine point. Panicle erect, linear or pyramidal. Branches verticillate, adpressed, 1—2 in. Spikelets many, 1 lin. long. Lower glume obtuse, almost hyaline, and very short. The 2nd empty glume nearly equal to the flowering glume.

Habit.—Received specimens from West Khándesh, where it is said to be reckoned as good fodder grass. I have reason to believe that it grows also in other districts of this Presidency, especially in dry, sandy, or saline soils.

"This grass is strictly confined to saline soils, and is found on all the *usar* tracts in N. India, often constituting the entire vegetation. As such it is not only useful as an unmistakeable indicator of reh-infected soils, but also by affording an abundant supply of fodder over large areas of land where other plants are unable to exist. The experiments now being undertaken at Aligarh and Cawnpore for the reclamation of reh-infected land are of great interest in regard to the changes affecting the growth of this grass. The immediate effect of excluding all cattle from *usar* land is the production of a more luxuriant growth of the *usar* grass, and its rapid extension over what were formerly bare efflorescent patches. At the same time other kinds of grasses quickly take advantage of the improved condition of the soil consequent on the more vigorous growth of the *usar* grass; for the thicker coating of *usar* grass helps to moderate the scorching rays of the sun, and in this way diminishes the upward capillary movement of reh salts. On all *usar* tracts there are usually to be seen patches of various sizes scattered here and there, usually in the form of ridges or mounds. These raised portions are nearly always found to support an assortment of plants indicating a distinctly different condition of soil compared to that of their surroundings. *Dub* and other valuable grasses form a large proportion of vegetation of these raised patches, and are ever ready to encroach wherever the ground in their immediate neighbourhood becomes fitted for their existence. The *usar* grass does not appear to be able to hold its own on ground which is capable of supporting these other grasses; it will, therefore,

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gradually disappear as the reclamation of the reh-infected tract proceeds"—*Duthie.*

5. S. COROMANDELIANUS, Kunth. Rev. Gram. Pl., 126; Dalz. and Gibs. Bomb. Fl. 296.

Vern.—Telingi name—*Yellika-tangoo-gadi* (Roxb).

Small cespitose plant, 4—8 in. Lower part of the culm surrounded with many rigid, acuminate leaves; serrate margins. Sheaths glabrous, as long as the internodes. Panicle $1\frac{1}{2}$ in.; branches verticelled. Spikelets very small, glabrous. Glumes acute, nearly equal to the flowering glume. Seeds naked, ovate rugose.

Habit.—Common in some places in Poona. Uses not Known.

Tribe VIII.—AVENANCEÆ, Kunth.

Spikelets 2—many-flowered in panicles or spikes. Rachilla articulate above the 2 lower glumes and more or less produced above the flowers. Flowers hermaphrodite. Glumes many, persistent below the articulation; flowering glumes 2, many, mutic, or with dorsal twisted awn, rarely erect, and straight.

52. CŒLACHNE, R. Br.

Spikelets small, 2-flowered, awnless, arranged in a panicle, the upper flower usually female, the lower hermaphrodite. Rachilla articulate below the flowers. Glumes obtuse, the 2 lower empty, smaller than the flowering one.

1. C. PULCHELLA, R. Br.; Benth. Fl. Austr. VII. 625; Thw. Enum. Pl. Zeyl. 373; PANICUM SIMPLICIUSCULUM, Steud. Syn. Pl. Gram. I. 96.

A small glabrous grass, flowering almost from the base. Culm filiform (in the specimens seen), decumbent, 5 in. long. Sheath $\frac{1}{2}$ in., striated. Leaves ovate, lanceolate, about 1 in., marked with strong lines, especially at the upper surface. Panicle 2—3 in., loose, narrow; branches filiform, short, erect or divergent, alternate. Spikelets numerous, almost imbricate, shortly pedicelled, often in pairs, or sometimes clustered in fours, ovate, scarcely $\frac{3}{4}$ lin. long. Both flowers fertile, the pedicellate smaller. The 2 lower glumes slightly unequal, thin, membranous, broad, convex. Flowering glumes thinner, ovate, smooth; the 3rd longer. Fruiting glumes not hardened.

Habit.—This grass is probably rare. Specimens received from Kumbarváda, in N. Kánara, only. Seen from a distance, at first sight it resembles a depauperated species of SETARIA INTERMEDIA, R. and S. Uses not known.

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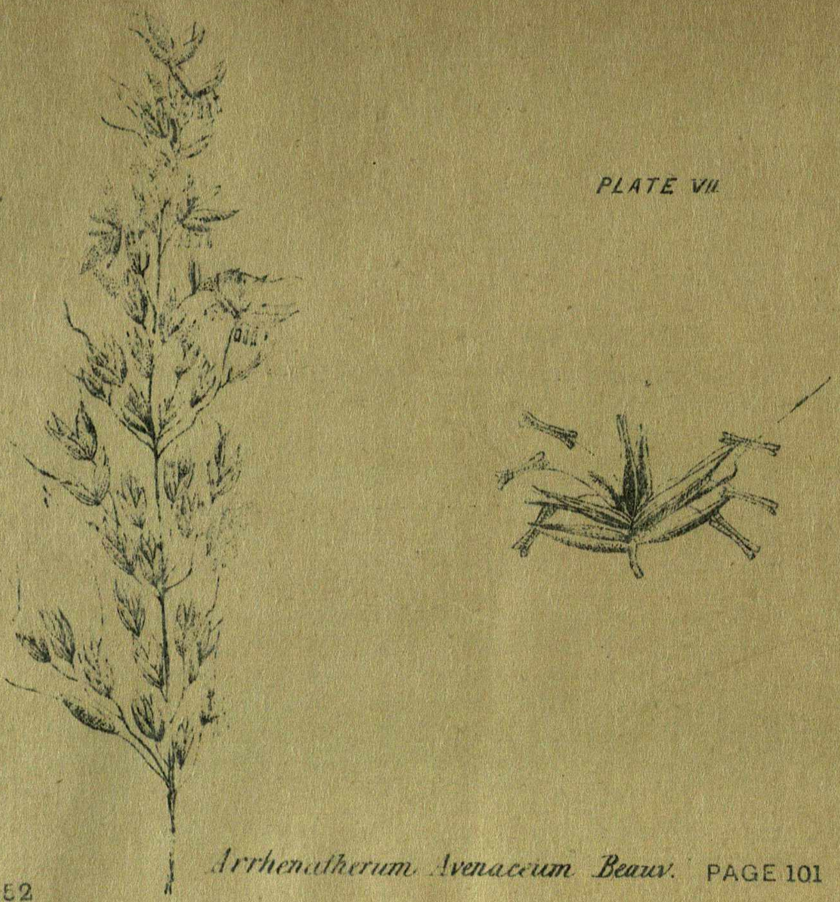
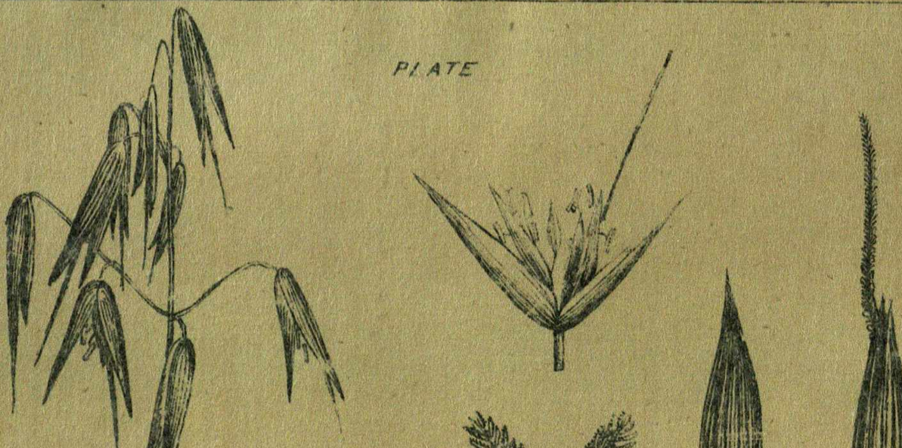
PLATE VII



NC.52 *Arrhenatherum Avenaceum Beauv.* PAGE 101

PLATE



NC.50 *Fig. 1* *Avena Sativa. After Nees, Gen: Germ.*

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53. TRISTACHYA, Nees.

Panicles loose. Spikelets in threes, on the branches of the panicle. Flowering glume of the male flowers awnless, that of the female flower deeply cleft with a long twisted and bent awn.

Species eight, in the tropics all over the world.

1. T. Stocksii, Boiss.

This is mentioned by Boissier as occurring in Sind and Beluchistán, but not seen by me. Its spikelets are congested in threes at the ends of the panicle branchlets. Each spikelet is 2-flowered, the lower male and the upper either hermaphrodite or female.

54. AVENA, Linn.

Annual. Spikelets nodding, distant, 2—6-flowered (rarely 1-flowered) in loose panicle. Rachis articulate above. Rachilla and the callus often hairy, the 2 outer empty, membranous glumes, tapering to a point. Flowering glume smaller, rounded on the back, many-nerved, often 2-toothed with a long dorsal twisted awn, sometimes wanting or straight in cultivated form. Ovary hairy. Styles distinct. The grain is furrowed in front, frequently adhering to the palea.

1. A. sativa, Linn. Gen.; Kunth. Enum., Suppl. Pl. XX. fig. 1; Dalz. and Gibs. Bom. Fl., Suppl. 97.

Vern.—*Vilaiti Jaw.*

This is the cultivated oat with the awns of the persistent flowering glume straight, or none. Some botanists believe that it has originated from the wild oat, A. fatua, described below :—

"The cultivators on this side treat it as barley and confound it with this grain. It is grown for its grain and fodder (straw) near some cantonments by cavalry officers and for race horses. It is largely grown for this purpose at the Saharanpur and Hapur Stud Depôts, and at the Hissar Cattle Farm, and is also stacked."

Dalzell and Gibson state that the oats are often used for the feeding of horses, but as the paleaceous matter is much more predominant than is the case in the oat of Europe, it often gives rise to *chronic* cough and huskiness. Hence many prefer the Cicer arietinum, or gram, to the oat as a horse food. (See Bomb. Fl. Suppl., 97.)

Habit.—It is extensively cultivated in some parts of Europe; its entire grains form an important article of horse-food, and, when

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ground, which removes the husk, it becomes oatmeal; this is used in the preparation of porridge and cakes, and forms a nutritious food, greatly used by the people of Scotland. What is called *Emden Groats* of the shops is the entire grain deprived of its husk and dried.

It is stated that rich natives near the chief towns and military stations are beginning to appreciate the value of the oatmeal as human food. The analysis of the Indian oat does not compare favourably with the oat grown in Europe. Whilst the latter yields albuminoids 12, oil 6, fibre 11, and ash 3 per cent., the former gives albuminoids 10·1, oil 2·3, fibre 16, ash 2·3. It is to be remarked here that, so far as the ratio of the nutrients is concerned, oatmeal is an almost perfectly adjusted food. (See Food-grains of India by Church.)

2. A. FATUA, Linn.; Kunth. Enum. I. 302.

Vern.—*Ganal, Ganhel, Ganer, Jandel.*

Culms erect, glabrous 2—3 ft. high. Panicle loose as in A. SATIVA; spikelets large, hanging from capillary pedicels. Flowering glumes 2—3 smaller than the empty glumes covered at the base with long brown hairs. Awn twice as long as the spikelets, bent about the middle. This is the wild *oat*, very troublesome as a field weed in crops.

Habit.—My specimens are from Sind. Nothing is known about its use in that district.

Mr. Duthie says:—"I have received no particular information as to its value for fodder in this country. Dr. Vasey in his 'Report on the Agricultural Grasses of the United States' mentions 'that some people have thought this species to be the original of the cultivated oats, but that the alleged facts are not sufficiently established. It differs from it in having more florets in the spikelets, in the long brown hairs which cover the flowering glumes, in the constant presence of the long twisted awn, and in the smaller size and lighter weight of the grain. It is a great injury to any grain field in which it may be introduced, but for the purpose of fodder, of which it makes a good quality, it has been much employed in California. It is said that in Portugal and Spain, hairy oats (A. STRINOSA) occur there cultivated."

55. ARRHENATHERUM, Beauv.

Habit of AVENA, but the spikelets are somewhat smaller, and the 2 flowers in each are different as to sex. Upper hermaphrodite or female with an awn arising from the base, the lower male

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PLATE VII

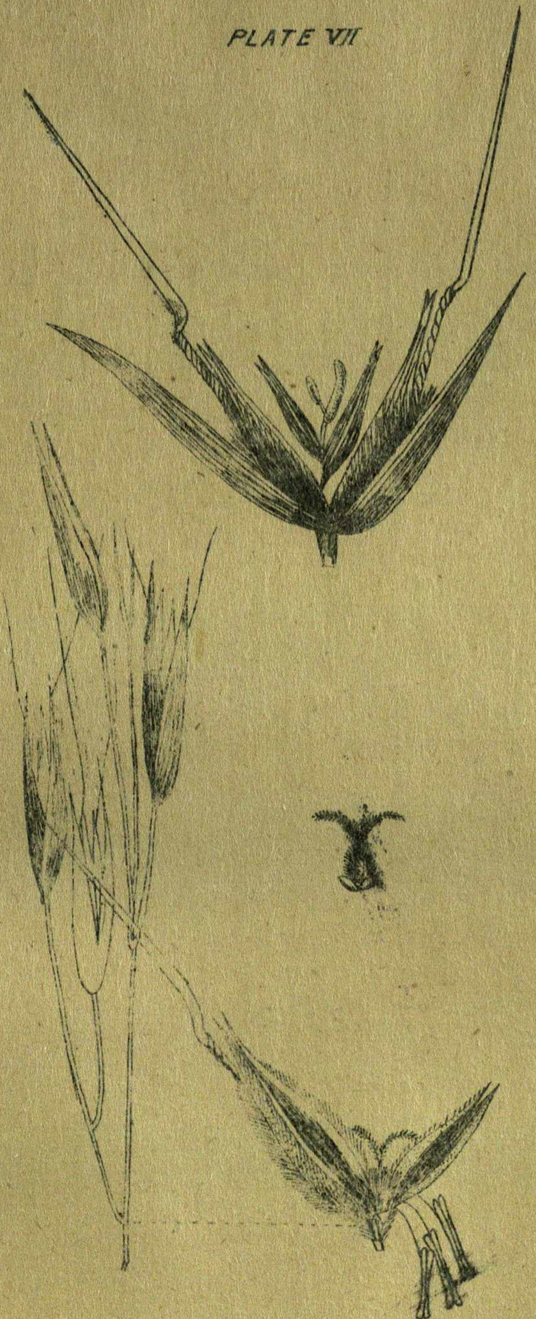

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Fig. 1. Avena fatua, Linn

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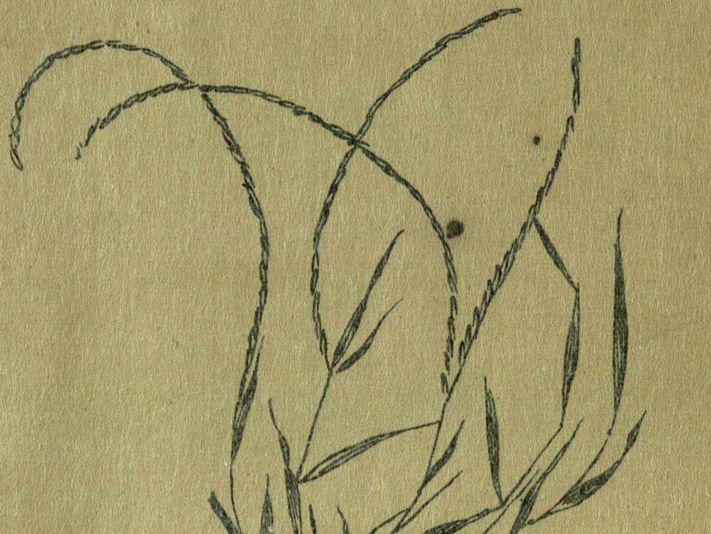

NO. 53

Microchloa setacea, R. Br.

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with strong awn from the top. The lower 2 empty glumes membranaceous, the flowering glumes rigid.

1. A. AVENACEUM, Beauv. Agrostide I. XI. fig. 51; A. ELATIOR, Linn.; Kunth Enum. Suppl. XXI. fig. 4; Jaub. and Spach. Ill. P., Cor. t. 198.

Root thick, a thick bulb. Culm slightly decumbent at the base, soon erect, 2—3 feet high. Nodes in the specimens seen villous. Sheaths sparsely ciliate, or glabrous. Leaves linear lanceolate, 8—12 in. long by 4 lin. Panicles 6—7 in. long, nodding; branches many, short, 4—5 together on the main axis. Spikelets large, 2—4 lin. Flowers pilose at the base, hermaphrodite, short or long, aristate or mutic.

Habit.—My specimens are from Sind. Nothing is known about its uses.

Tribe IX.—CHLORIDEÆ.

Spikelets 1—many-flowered, sessile, in 2 rows on simple unilateral spikes, which are either solitary and terminal or digitate or scattered along the peduncle of the panicle.

56. MICROCHLOA, R. Br.

Spikelets 1-flowered, awnless, hermaphrodite, sessile, secund on a slender simple spike. Outer glumes 2, nearly equal. Lower 2 glumes empty; the 2nd glume keeled. Flowering glume and palea smaller, thin and hyaline. Styles distinct. Stigmas plumose. Caryopsis fusiform, free in the glume and palea.

Species 3; of these the following is distributed over the tropics of both hemispheres, the other 2 are natives of Africa—all very small and delicate.

1. M. SETACEA, R. Br. Prod. 208. Roxb. Cor. Pl. t. 132 (under the name of ROTTBŒLLIA).

A small cespitose plant. Culm very slender 3—9 in. high. Leaves very narrow, 1½ in. long. Spike 1—3 in. long, very slender and curved. Spikelets about 1 line long. Empty glumes very pointed. Flowering glume hairy outside, but very transparent.

Habit.—Bádámi, Dhárwár. Grows over the tropical and subtropical regions of both hemispheres. Uses not known.

57. GRACILEA, Koen.

Small grasses. Leaves short. Spikelets 1—2-flowered (flower unisexual?) collected in turbinate awned deciduous spicate clusters which are secund sessile and jointed on a filiform and

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capillary flexuous terminal rachis; rachilla not jointed, sometimes produced beyond the 4th glume and bearing an imperfect flower. Glumes 4—6; 1st and 2nd narrow, rigid, ciliate with long hairs, narrowed into long rigid scabrid awns. 1st narrowest; 2nd with broad hyaline margins; 3rd and 4th broadly ovate, membranous, scaberulus, 3-nerved, shortly awned, tip entire or 2-cuspidate; palea as broad as the glume 2-cuspidate, lodicules cuneiform. Anthers small. Grain oblong, free. Species 2, Indian and African.

1. G. Royleana, Nees, Ann. Nat. Hist. VII. 221; Eutriana Abyssinica, R. Br.; Melanocenchris Jacquemontiana, Jaub. and Spach.; M. rothiana, Dalz. and Gibs. Bomb. Fl., 297.

Vern.—*Gooli, Bedari, Dongri, Landgeya-Kussal* or *Landga-Kussal* (Landga means wolf, the grass is supposed to resemble this animal).

Culms filiform, 4—6 in. or more high, branched. Leaves short, narrow, pointed, edges ciliate. Spikelets sessile in 2 rows, and falling away at the joints. The flowering glume almost always glabrous, trifid, with three straight awns of a brownish colour, the 2 lateral shorter.

Habit.—This small grass is very common in stony and barren places in the Konkan and Deccan; also in N. India. Reports from Tulápur (Poona) state that it is not good fodder. Mr. Duthie on the contrary states: "It is said to be a good grazing grass when young, though rather too small to be of much use."

58. **TRIPOGON**, Roth.

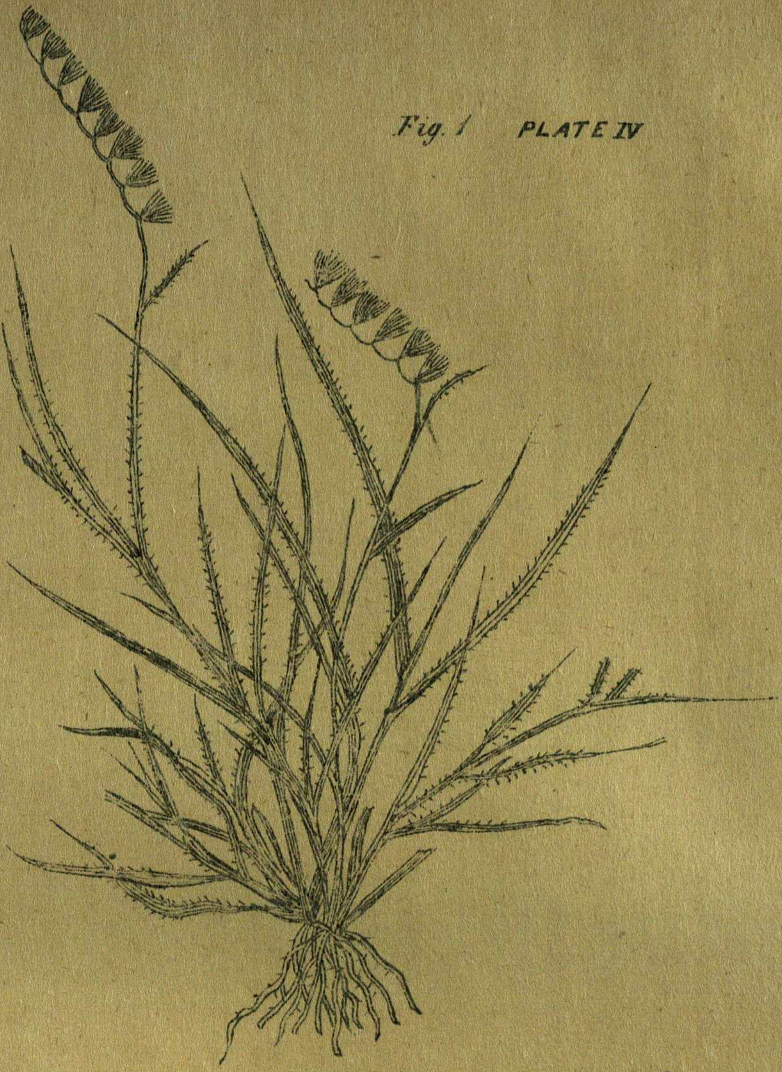
Spikes terminal, solitary, elongated. Spikelets with many sessile hermaphrodite flowers, or the highest 1—2 males or sterile, arranged in 2 rows on long unilateral spikes. Empty glumes 2, persistent, keeled, acute, more or less unequal. Flowering glumes 3-nerved, 3-awned; awns straight; the lateral shorter rarely reduced to a mucro. Cespitose grasses with very narrow leaves.

Habit.—Species 9—10 in India and tropical Africa.

1. T. capillatus, Jaub. and Spach.

A delicate, cespitose, glabrous grass. Culm very slender. 1—$1\frac{1}{4}$ ft. high, channelled on one side, that of spikelets. Leaves very narrow, 4—6 in. by about $\frac{1}{8}$ in., involute when dry. Spike long, occupying about $\frac{3}{4}$ of the culm. Spikelets 3—4-flowered, linear, sessile or very shortly pedicellate, but distant along the rachis of a simple spike, the rachis of the spikelet with a tuft of hairs at the base of each flower. The distance between each spikelet is equal to $\frac{1}{4}$ in. 1st glume $\frac{1}{40}$ in., empty; the 2nd glume $\frac{13}{40}$ in., with long

Fig. 1 PLATE IV



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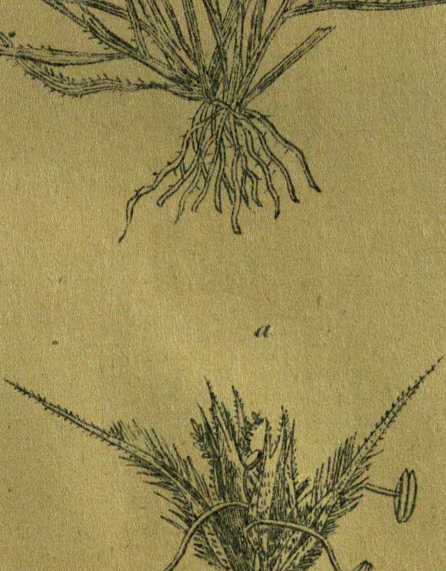

NO.54 [illegible] Royleana. Jaub et [illegible]

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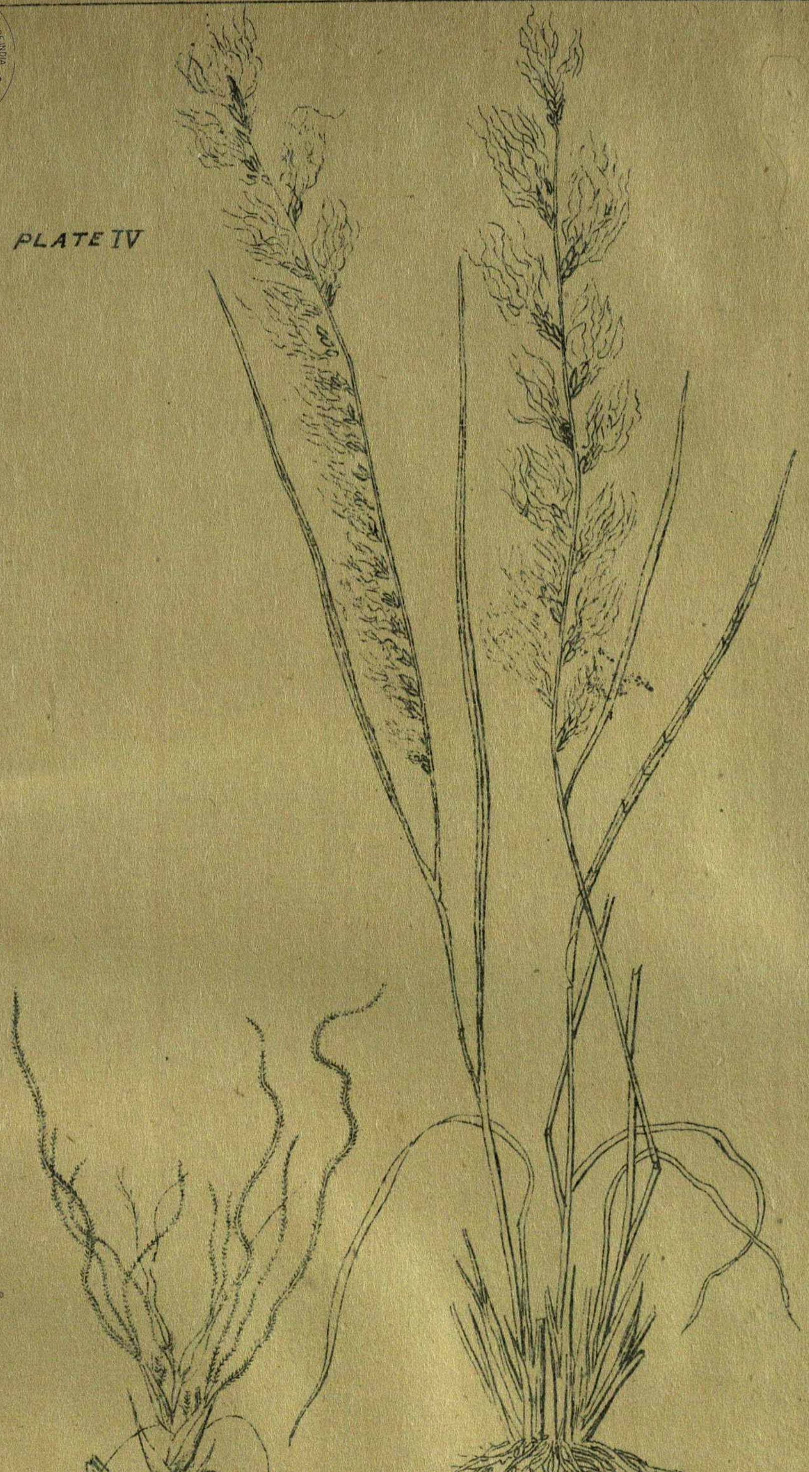
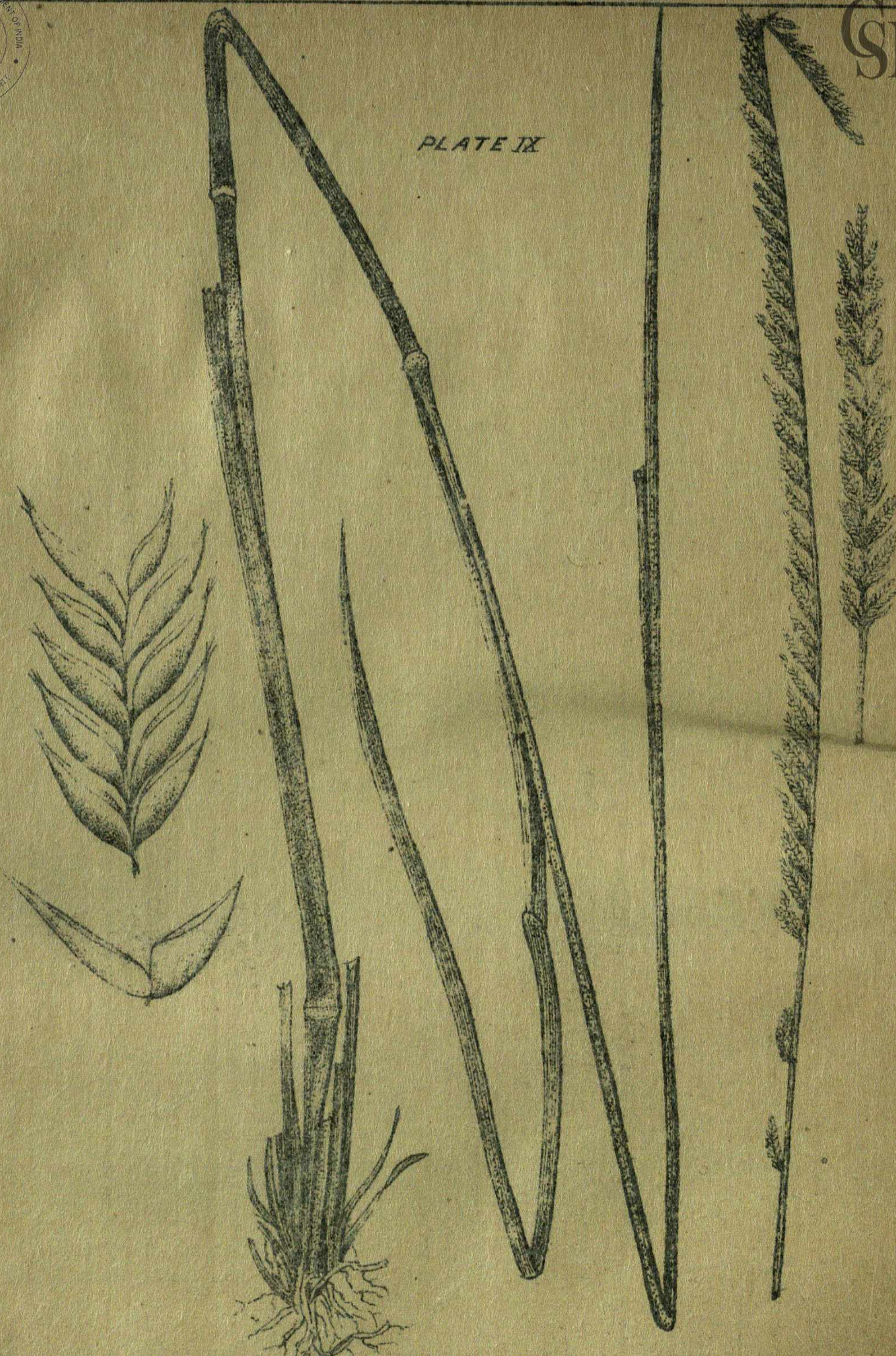
PLATE IV



NO.53 *Fig. 2. Tripogon Capillatus. After Jaub et Spach*

PLATE IX



NO.36

Tripogon Lisboa, Stapf Sp. Nov.

Drawn from nature by M.I.R.

acumen or point. Flowering glumes with long awns, about ½ in. Palea very small, hyaline. Stamens 2. Styles 2, stigmas plumose.

Habit.—The specimens before me were found growing on the stem of a tree at Mátherán. Communicated by Mr. Woodrow.

It is stated that it was found by Jacquemont growing on trees at Poona.

2. T. PAUPERULUS, Stapf. Hook. Icon. Pl. 2442.

Culms very slender, 2—2½ in high, glabrous. Sheaths striated more or less loose. Ligula membranaceous ovate. Leaves very narrow, setaceo-acuminate, with about 11 nerves. Spikelets on the top of culms, about 4 lin. without the awns. 1st glume symmetrical, 1-nerved, acuminate; 2nd glume similar but longer and aristulate. Flowering glumes usually 4, oblong, awned between the lobes; the awn geniculate, contorted below, 5 lin. long.

Evidently allied to TRIPOGON CAPILLATUS, Jaub. and Spach., but distinct in the symmetrical outer glume and the different armature of the spikelets, particularly the much stouter and shorter middle awn of glume 3.

Habit.—On trees and rocks near Lonávla (Woodrow).

3. T. LISBOÆ, (Nov. Sp.) Stapf.

Culm straight, single, 2—2½ ft. high. Sheath a little shorter than the internodes, obsoletely striated. Ligula very minute or obsolete. Leaves glabrous, rigid, about 1½—2½ lin. broad at the base, 4 in. to 1 ft. and a half long, ending in a long narrow point (at the base pilose and run over with 7—9 scleromatic vessels—Stapf.). Spike narrow, simple, straight or sometimes falcate 10 in. long by 4 lines. Spikelets appressed, sessile, compressed, alternate in 2 rows, somewhat secund, 3—7 lin. long, 6—12-flowered. The 2 lower glumes empty; the lowermost smaller ¾ in. long; unequally divided by a distinct nerve which runs up from the base to the top; the largest part towards the rachilla gradually enlarges from the base up to ⅔rd, and then becoming narrower ends obliquely at the upper end of the nerve. The angle at the junction of the lower with the upper oblique portion projects out into a very small obtuse tooth; 2nd glume lanceolate, 2—3 lin. long with a thick central nerve. Flowering glumes 5—12 with very short hairs at the base, ovate-lanceolate, 1½—3 lin. long, keeled, the keel running into a mucro, or short thin awn (¼—⅓ lin. long) with or without minute points (obsolete or suppressed mucros ?) on each side. The uppermost 1 or 2 glumes empty. Palea nearly equal, 2-ribbed, and 2-dentate. Caryopsis oblong terete.

Habit.—Mátheráu, Konkan, Kánara, Mysore to Mt. Aboo. On rocks near the Kárli Caves, near Poona, Rájputána also on rocks.

There are 2 varieties of this grass, one with short spikelets and a few flowers, and the other with longer spikelets and with more flowers. Both varieties are elegant.

4. T. JACQUEMONTII, Stapf.

Greenish, glaucous, glabrous. Culm slender, erect, or slightly bent at the base, 1½—2 ft. high. Sheath rather loose, a little shorter than, or nearly as long as the internodes. Ligula very minute, ciliate. Truncates chiefly at the base. Blades linear, ¼—1 lin. broad, 3—6 in. long, rigid with 17—19 fine scleromatic lines or vessels on the upper surface (Stapf). Spike simple, straight, or more or less flexuose or nodding; 5—6 in. long, white, many-flowered. Flowers crowded and rather secund. Spikelets sessile, somewhatcompressed, apparently cylindric, alternate, narrow, 5—13 lin. long, many (13—19-flowered). 1st glume small and like in T. LISBOÆ unequally divided by a nerve, but the projected angle is truncate, not obtuse. Flowering glumes with a few short hairs at the base, 3-nerved, 3-awned, the central awn longer (⅓ lin. long) than the lateral. These are obsolete or reduced to very short thin hairs. Terminal 1—3 glumes empty. Palea 2-nerved, slightly shorter than the flowering glumes. Caryopsis narrow, oblong terete.

Habit.—This grass is found growing in Poona, Sholápur, Konkan and in the same localities as the last species. Said to grow also in Bengal. It is named after Jacquemont, as he was the first to collect it in Poona.

59. CYNODON, Pers.

Spikelets 1-flowered, awnless in 2 series, arranged in unilateral digitate spikes. Lower empty glumes 2, keeled, persistent or deciduous Flowering glumes broader and longer, boat-shaped. Palea narrower, nearly as long with a small bristle at its base; sometimes there is a rudiment of a second flower.

Species four, three in Australia, the fourth (the following) cosmopolitan, extending to temperate regions.

1. C. DACTYLON, Pers.; Kunth. Enum. I. 259; Dalz. and Gibs. Bomb. Fl. 297; PANICUM DACTYLON, Linn. Sp.; DIGITARIA STOLONIFERA, Schrad. Fl. Germ., t. 3, fig. 9; Beauv. Agrost., t. ix. fig. I.; Sibth. Fl. Gr., t. 60.

Vern.—*Doorba* or *Durva* of the Hindus, sacred to Ganesh, *Harala* or *Haryeli* of the Bombay people, *Gericha* of the Teling (Roxb.) *Arugam-pilla*, Tamil (Roxb.). In some other parts of

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PLATE II

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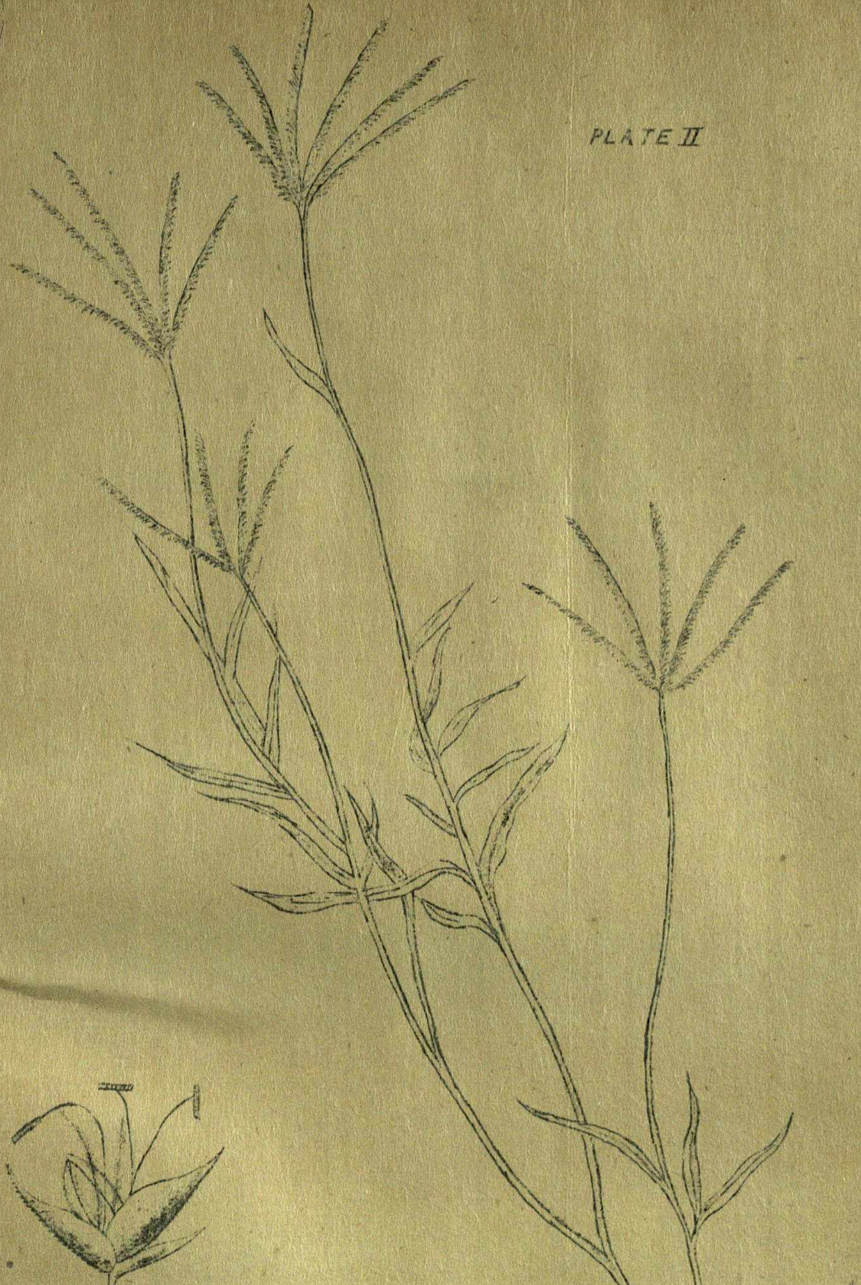

NO 57

Cynodon Dactylon, Pers.

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India it is known by the name of *Dubra dub; Nili dub, Rám ghas, Khabbar* (Duthie).

Stem perennial, prostrate, often creeping and rooting to a great extent, the flowering branches shortly ascending. Leaves short, rigid, distichous. Spikes 2—5, sometimes 6—8, digitate, at the end of a long, slender, often purplish peduncle 1—1½ in. long. Spikelets linear, smooth, sessile. Lower glumes narrow, acute, pointed, persistent, keeled, nearly equal, less than 1 line long. Flowering glume rather longer and broader, boat-shaped, the keel minutely ciliate, hardening when in fruit, and smooth on the sides.

Habit.—It is abundant everywhere in this and other Provinces of India. It is said to be rare in very sandy parts of the W. Punjáb and in the black soil of Central India. Grows also in Ceylon and over the greater part of the world. Rare in England and other parts of Europe; abundant in the western slopes of the Andes, China, Thibet, South and Central America, and the Cape of Good Hope, and according to Birdwood is said to have been introduced into Farz and Khuzistan by the British Expedition of 1856-57. It is considered to be the best and most nutritious fodder grass for cattle, and specially for horses, in India, Ceylon, in the United States of America, and in Australia. It is now generally spread in the settled parts of the latter country. R. Brown suggests that it may have been introduced with cultivation. It varies considerably in habit as well as in its nutritious properties.

It makes excellent hay, and will keep good in stock for many years. Mr. Fergusson says :—"Its flowers in their perfect state are among the loveliest objects in the vegetable world, and appear, through a lens, like minute rubies and emeralds in constant motion from the least breath of air. It is the sweetest and most nutritious pasture for cattle; and its usefulness added to its beauty induced the Hindus, in their earliest ages, to believe that it was the mansion of a benevolent nymph. Even the Veda celebrates it as in the following text of the *A'tharvana*: 'May Durva, which rose from the water of life, which has a hundred roots and a hundred stems, efface a hundred of my sins, and prolong my existence on earth for a hundred years.' It is also sacred to Ganesha. Durva and Doorba must not be confounded with Darbha, a synonym of the celebrated *Cusha* grass. Sir W. Jones and others, ex. Birdwood, Bombay Products, p. 128."

The following extracts taken from Dr. Vasey's "Report on the Grasses of the South," pp. 26-28 (1887), show how highly valued this grass is in America, where it is known under the name of Bermuda Grass. "In Louisiana, Texas, and the South generally, it is and has been the chief reliance for pasture for a long time, and immense herds of cattle on the southern prairies subsist prin-

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cipally on this food...............it has the capacity to withstand any amount of heat and drought, and months that are so dry as to check the growth of *Blue-grass* (POA ARACHNIFERA) will only make the *Bermuda grass* green and more thrifty." (Professor Kilbrew.)

"*Bermuda grass* grows on any kind of soil in Texas, but will not stand the trampling of stock on loose sandy soil. It is hard to beat for a grazing grass, though long continued droughts cause it to dry up." (Mr. M. M. Martin, Central Texas.)

"While this is the most northern limit of *Bermuda grass*, it is also the most southern limit of the *Blue-grass*. The two growing together on the same land produce a most perfect pasture, as the *Blue-grass* is green, all the fall, winter, and spring months, while during the heat of summer, which prevents the growth of the *Blue-grass*, the *Bermuda* flourishes. The two together in good strong soil make a perfect pasture good all the year round." (Mr. J. B. Wade, N. Georgia.)

"The time is not far distant when all the rough feed consumed on plantations will be made of this grass, and when the planter will consider his hay crop of more importance than his sugar and cotton. No other grass will yield such an amount of valuable hay, surpass it in nutritious qualities, or support on an acre of pasture such an amount of stock" (Mr. Affleck in Professor Kilbrew's "Grasses of Tennessee.")

Colonel Otley has written a long article in the Madras Literary Journal on the cultivation of this grass as fodder for cavalry. This article is copied in Johnson's 'Grasses of India' with a few useful observations.

60. **CHLORIS**, Linn.

Spikelets with 1 fertile flower and 1 or more empty glumes above them, arranged in secund digitate spikes. Glumes keeled, 2 lower empty ones persistent, acute or shortly awned. The flowering glumes firmer in texture and broader and awned; one to several empty glumes above, which are usually broadly truncate and often awned.

Species about 40 in the tropics of both hemispheres.

1. C. PALLIDA, Hook. f.; SCHŒNEFELDIA GRACILIS, Kunth. Enum. Pl. I. 258; S. RAMOSA, Trin. Sp. Gram. I. 359; S. PALLIDA, Edgew., Asiatic Journal, 1852, p. 183.

Glabrous, 7—8 in. high. Sheath and leaves ciliolate at the margins. Leaves linear, ending in a long point. Spikes 2—3 in. long, terminal, solitary or 2—3 together, secund, densely flowered. Spikelets sub-sessile, 1-flowered in 2 rows. Lower 2 glumes empty,

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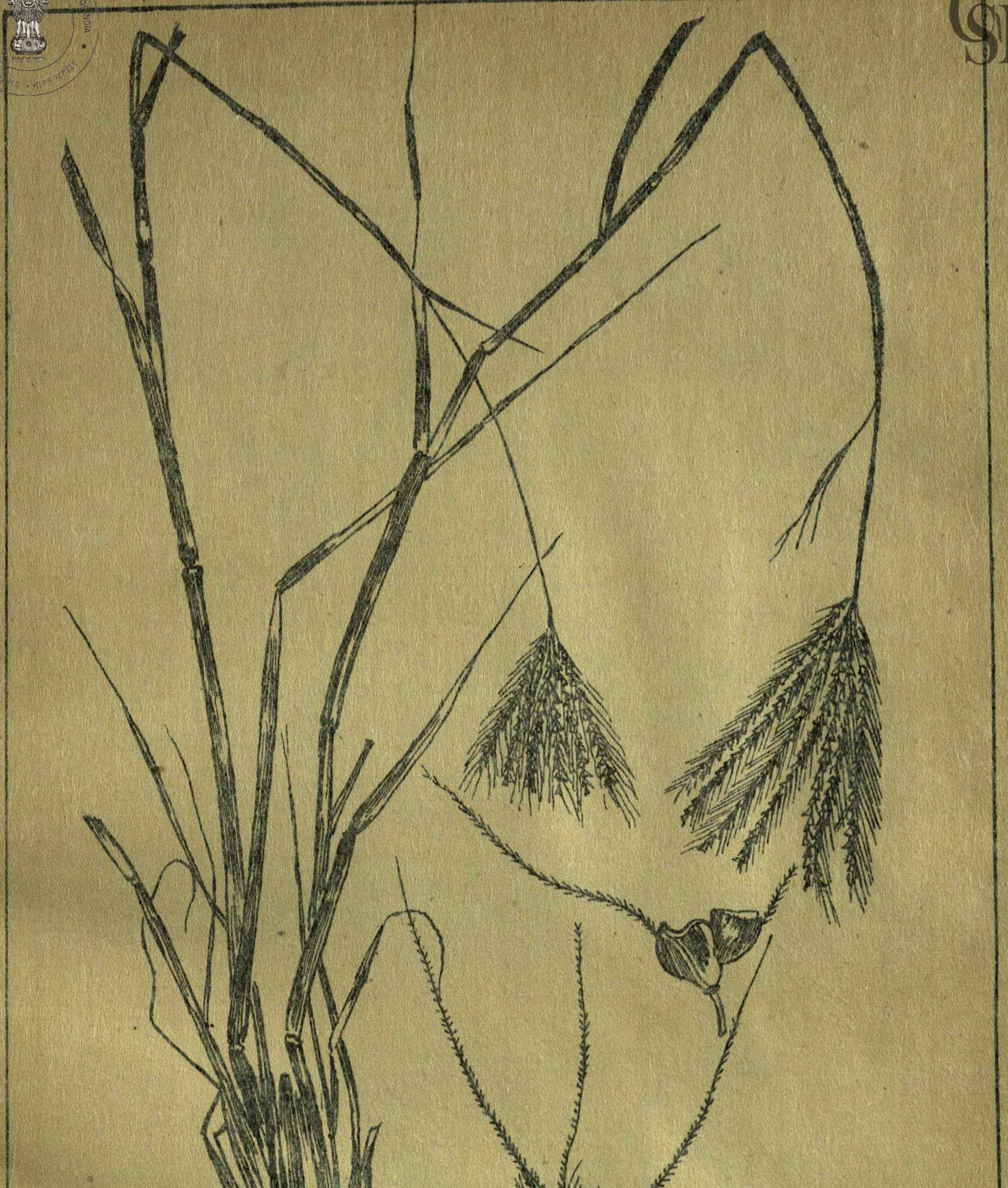

No. 58. *Chloris barbata, Swartz.*

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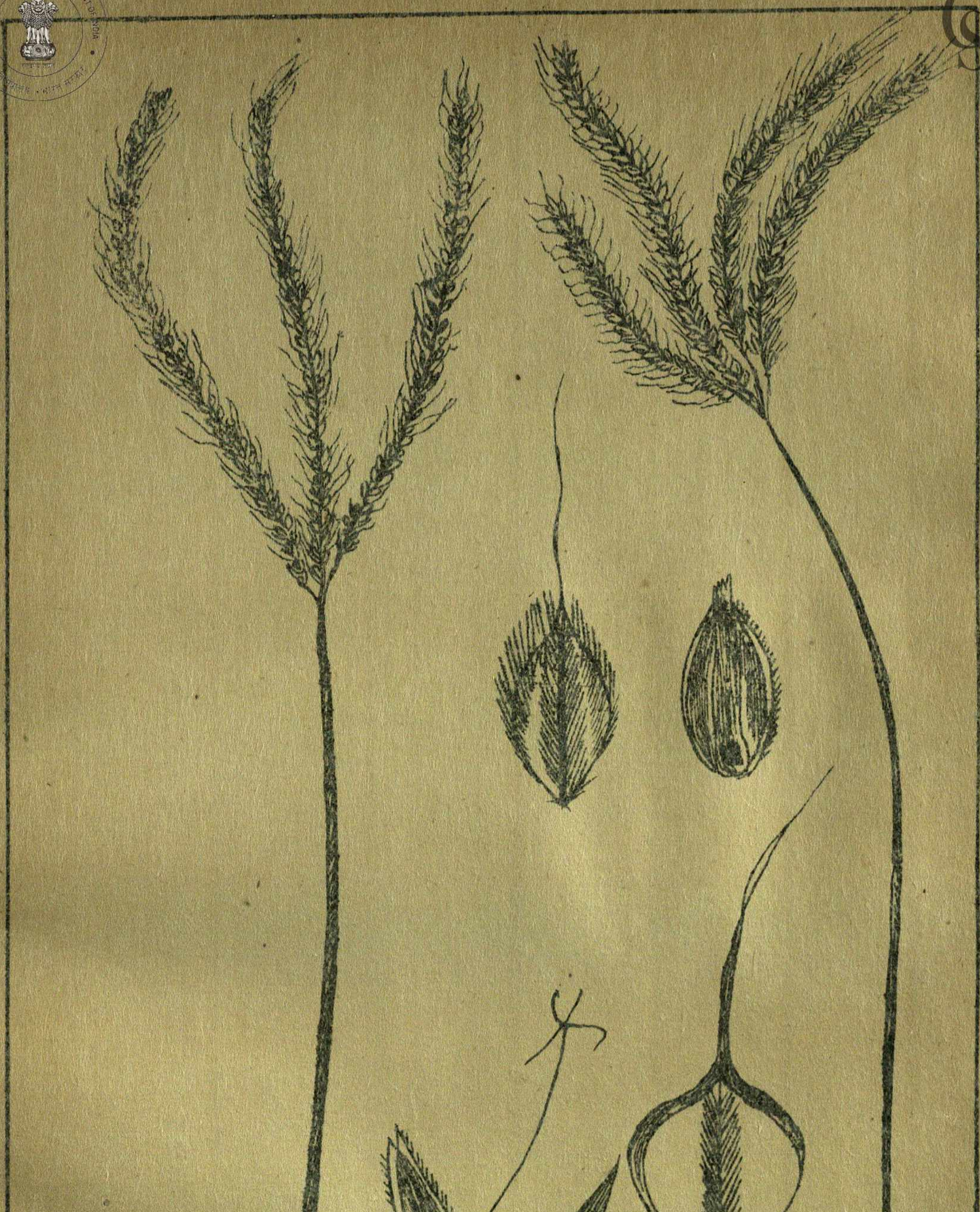

No. 59. *Chloris montana, Roxb.*

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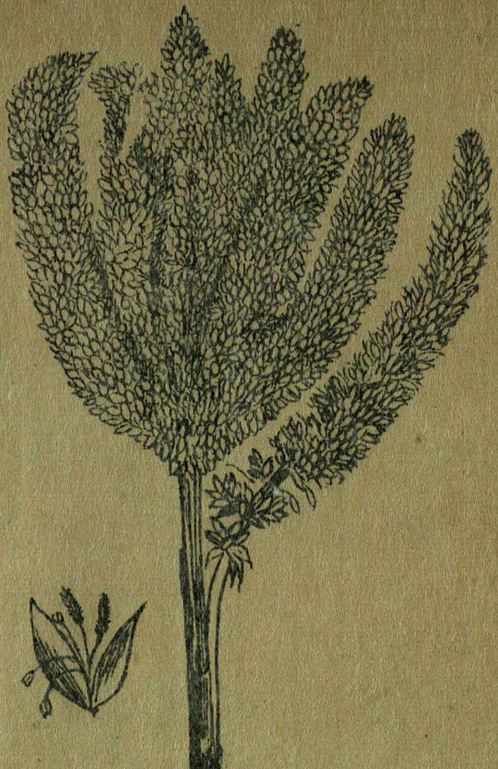

No. 60.

Eleusine corocana, Gaert.

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persistent, unequal, the lowermost a little shorter; the 3rd emarginate or bifid, villous, shorter than the 1st, with a long, more or less bent awn. The whole plant is glaucous and looks very pretty with its slender spikes and their long awns.

Habit.—It is rare, scattered all over India in Banda and dry sandy ground in N. W. India, also in the ravines bordering the Jumna and Chambal river. This grass grows also in Senegambia, Nubia, and the Cape Verde Islands. My specimens are from Mahim and Bodeli, Gujarát. Its uses are not known.

2. C. INCOMPLETA, Roth.; MELICA DIGITATA, Roxb. Fl. Ind. I. 328; CHLORIS DIGITATA, Edgew., Asiatic Journal, 1852, p. 183.

Vern.—*Kuncha*, *Bamna*, *Mathanya*, *Nika gadi*, and *Sala kodam gadi* (Duthie).

Culms slender, decumbent at the base and then ascending when growing amongst bushes, 4—5 ft. long or longer. Sheaths hairy at the mouth. Leaves pilose, chiefly on the upper surface. Spikes 4—5, filiform, terminal, digitate, expanding or divaricate, 6—9 in. The 2 lower glumes unequal, shortly awned, 3—4 times longer than the 3rd. Flowering glume with a long awn issuing just below the apex at the dorsal surface. The upper glume or neuter floret rudimentary, awned.

This is a large beautiful species. When it grows amongst bushes it attains a considerable height. It resembles at first sight some of the large specimens of PANICUM SANGUINALE.

Habit.—Not uncommon in this Presidency, nor uncommon in N. India. I have received specimens from Khándesh, Násik, Thána, and from S. India.

3. C. TENELLA, Roxb. Fl. Ind. I. 200.

Vern.—*Kagya*, *Morbhago* grass (Duthie).

Culm slender, smooth, glabrous, 1 ft. high or higher. Leaves smooth, soft, glabrous, long in proportion to the plant, often longer than the stem. Spikes terminal, solitary, or very seldom 2, about 2 in. long. Spikelets 3—5-flowered, distichous or alternate, all hermaphrodite except the last which is often rudimentary. Glumes unequal, broad, lanceolate, acute. Flowering glumes broad, cucculate, awned.

Habit.—It is stated in the "Bomb. Flora" "This is a rare grass according to Roxburgh, and we have not met with it in more than one place, *viz.*, in the city walls of Surat." I have received specimens from Surat, Dhulia, Poona, and the Loni Reserve on the banks of the Mutta Mulla river, where it is extremely local and by no means plentiful. Mr. Wroughton, Deputy Conservator

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of Forests, has found it in the Late, Murum and Reserves on the bank of the Nira river. "Here it grows in abundance and strongly. I had to wade through patches which were above my knees and covered considerable areas." (Wroughton.)

Duthie has discovered it in Rájputána, Bundelkhund, and the C. Provinces. The uses of this elegant grass are not known. At Ajmere it is reckoned to be a good fodder.

4. C. BARBATA, Swar. Fl. Ind., Pl. 200; ANDROPOGON BARBATUS, Linn.

Vern.—*Gôshua*, *Aptia*, *Gondwal*, *Chanderyot*, *Phulkia* (Balaghát), *Chinkri* (Jeypur), *Gandi gavung* and *palriah* (N. W. Provinces by Royle), *Ganni* (Punjáb).

Culm glabrous, compressed. Sheaths ciliate at the mouth. Leaves acute, befarious at the base of the culm, shortly hairy on the upper surface. Spikes 6—12, digitate, 1½-2 in. long. Spikelets 2-flowered, imbricated, the lower sessile, hermaphrodite. Lower glumes 2, empty, awnless; flowering glume keeled, ciliate at the end, with rather long hairs, and produced into a long straight awn. The upper floret consists usually of 2 empty glumes, often awned. The palea hairy.

Habit.—Common all over India and in Ceylon. In Australia reckoned to be a good fodder. Cattle eat it till it flowers, after which they will not touch it.

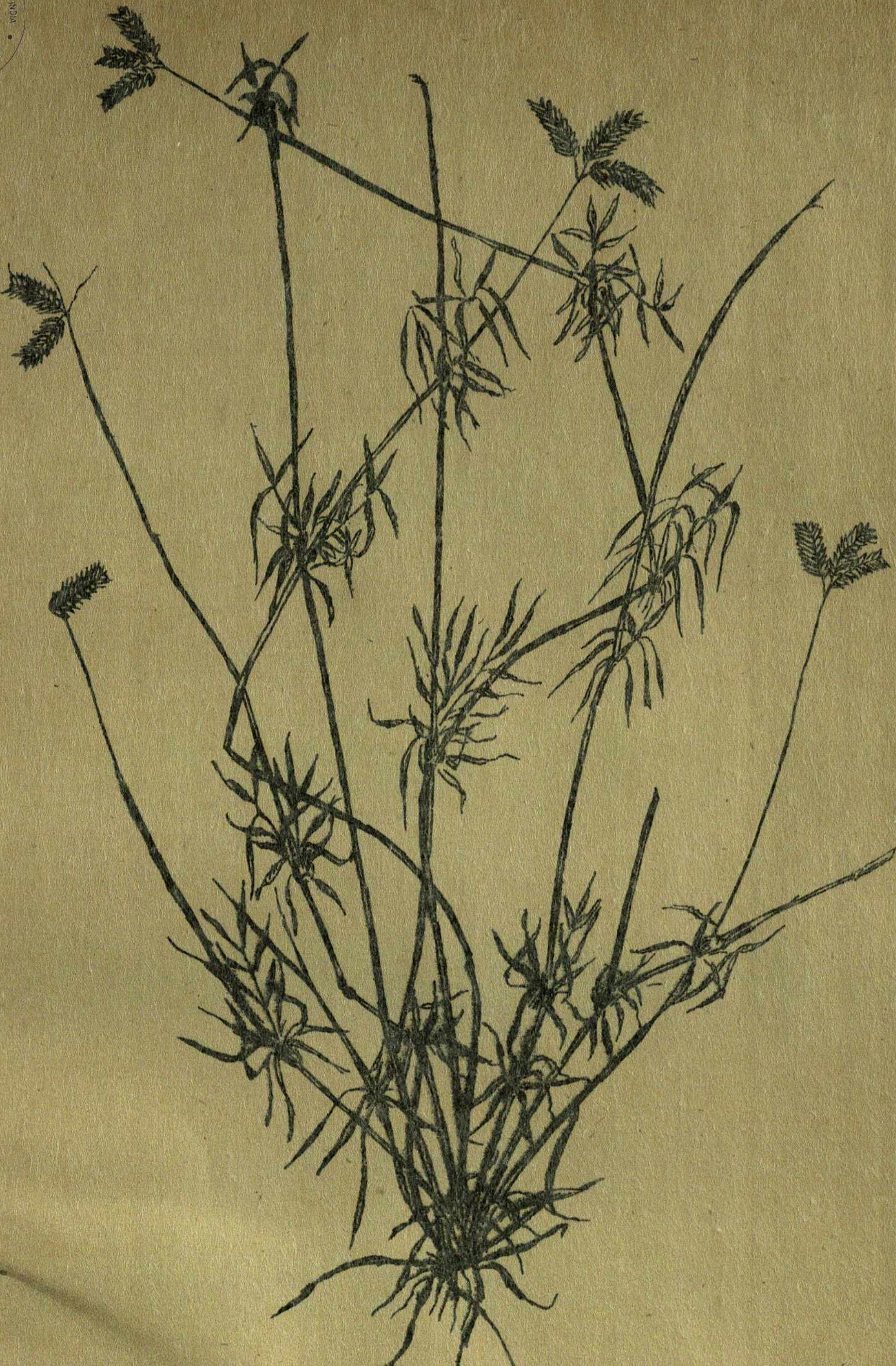
5. C. POLYSTACHIA, Roxb. Fl. Ind. I. 332.

Culm slender, erect, or decumbent at the base, and then ascending, about 2 ft. high. Leaves smooth, sparingly hairy on the upper surface. Spikes numerous, usually about 20, terminal, digitate, or fasciculate, umbelled, 2-2½ in. long. Spikelets alternate in 2 rows, sessile, imbricate, with one hermaphrodite flower. Glumes 2, unequal, lanceolate, keeled, smooth, awnless. Flowering glume of the hermaphrodite flower produced into a fine straight awn, ciliate at the margins. The *rachis* bears at the top 2 pedunculated awned glumes.

Habit.—The plant is rare. My specimens are from the compound of the Grant Medical College and from the neighbourhood of the Victoria Gardens. Is it a variety of CHLORIS BARBATA with more numerous spikes?

6. C. MONTANA, Roxb. Fl. Ind. I. 329.

This is a variety of CHLORIS BARBATA, with four to six spikes only, the spikelets large, like those of C. TENELLA, often of a purplish colour.



No. 62 *Eleusine flagellifera, Nees.* DRAWN FROM NATURE

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There is another beautiful variety of C. BARBATA with long, flexuose spikes, 4½—5 in. long; spikelets smaller than in C. MONTANA, white, awns short and straw-coloured.

Habit.—The specimens were received from Násik.

61. ELEUSINE, Gaertn.

Spikelets many-flowered, awnless, sessile, crowded in 2 rows along one side of the digitate or verticillate spikes. Glumes keeled, obtuse, closely imbricate, obtuse or mucronate, the 2 lower ones empty, shorter than the flowered ones. The axis is usually slightly produced above the last glume. Seed transversely wrinkled, and often, specially in *Náchni*, loose within the pericarp.

DACTYLOCTENIUM, described by some agrostologists, is a variety, in which the spikes are short and dense, the empty glumes prominently mucronate, and the pericarp absorbed before the fruit ripens.

1. E. COROCANA, Gaert. Carp. 1; Roxb. Flor. Ind. I. 342; Dalz. and Gibs. Bomb. Fl. Suppl. 97; CYNOSURUS COROCENUS, Linn. Sp. Pl.; TSJETH PULLU, Rheed. Hort. Mal. XII., t. 78.

Vern.—*Natchni, Nagli, Raggi, Mandha, Mandhua, Maruya, Marua, Modua*; *Mandol, Cholodra*; *Hoda*; *Kurakan.*

Culm erect, 2—4 ft. compressed, simple, smooth. Sheath bearded at the mouth. Ligula short, fimbriate, pilose. Leaves bifarious, large, 1 ft. long or longer than the culm. Spikes 4—7, digitate, usually incurved, sometimes straight, thick, secund, 1—3 in. long. Spikelets sessile, densely imbricate, in 2 rows, 3—6-flowered. The 2 lower glumes empty (the lowermost longer), keeled, obtuse. Flowering glume ovate, concave, obtuse, glabrous, minutely denticulate. Fruit globular, dark brown, rugose. Pericarp loose over the seed.

Habit.—Extensively cultivated over our gháts and in the plains and lower districts more than 20 miles inland. It is transplanted and weeded like rice. It may be grown almost over stones and gravel, but when sown over a rich soil, the return is enormous in proportion to the area. It yields from 5—6 maunds of seed per acre upon the hills, 12—14 maunds in the plains.

Dr. Roxburgh describes a luxuriant variety, E. STRICTA. For this variety Dr. Roxburgh gives "an increase equal to 120 fold, and for another 500; whilst on two tufts, the produce of one seed, grew 50 culms, and no less than 8,100 fold seeds were carefully calculated to be the produce of this plant. Generally this grain is sold at the rate of 80 to 130 lbs. a rupee. It is considered by natives to be the most nourishing and invigorating of cheap food. On analysis *natchni* grain has been found to contain on an average 6·53 per cent. of nitrogenous matter. In this respect *natchni* stands last amongst the cereals of India. Dr. Forbes Watson thinks that want of nitrogen is more than compensated by the mineral constituents of *Raggi* (*natchni*). It is rich in iron required for the blood corpuscles, and in potash, lime and phosphoric acid essential to various tissues of the body. On the whole *natchni* stands high in food value." The portion of phosphoric acid in the grain is about 0·4.

It is extensively used by the poorer classes of Patna, Bhagalpur, Dinajpur, Gorakpur, Behar and other districts of N. India. In Mysore and other parts of S. India it is the staple food; sometimes stored there in pits, when it keeps without being deteriorated for years. *Natchni* is eaten in the form of cakes made of the flour, mixed with a sufficient quantity of water and sugar, and baked. The flour is also used by its being stirred with water, then boiled and formed into a sort of thick porridge, named *ambil*, in Goa and in the S. India. Well-to-do people make a sort of pudding, which they call *tisana*. It is said that in Darjiling a fermented liquor is prepared from the *natchni* grain. The stacks are given to cattle as fodder or used as fuel.

Natchni has not been found in a wild state. Is it the result of the cultivation of the next species, which resembles it, and the grain of which is eaten by poor people during scarcity or famine times? Fergusson believes that the name ELEUSINE COROCANA, given by Gaertner and Linneus to this plant, is derived from "the Singhalese *Kurakan* under which it has been known to, and cultivated by the natives (of Ceylon), times out of mind."

2. E. ÆGYPTIACA, Pers. Syn. I. 82; Roxb. Fl. Ind. I. 345; CYNOSURUS ÆGYPTICUS, Linn. Sp. Pl. 106; DACTYLOCTENIUM ÆGYPTIACUM, Willd., Kunth. Enum. Pl. I. 261; Dalz. and Gibs. Bomb. Flor., 297.

Vern.—*Makra*, *Madhana*, *Kark-medhana*, *Malicha*, *Mansa*, *Mathna*, *Chikara*, *Chota-Mandya*, *Makar Jali* (Duthie and Roxburgh).

Culm creeping and rooting at the lower nodes, then ascending to about 1 ft. or more, slightly compressed. Sheath sparingly hairy. Ligula very short, ciliate. Leaves flat, flaccid, tapering to long points, hairy. Spikes 3—5, digitate, secund, varying from ½—1 in. Spikelets numerous, 3—5-flowered, closely imbricate on the underside of, and at right angles to, a prominent angular rachis. Lower glume acute, about 1 lin. long; the 2nd broader, obtuse or

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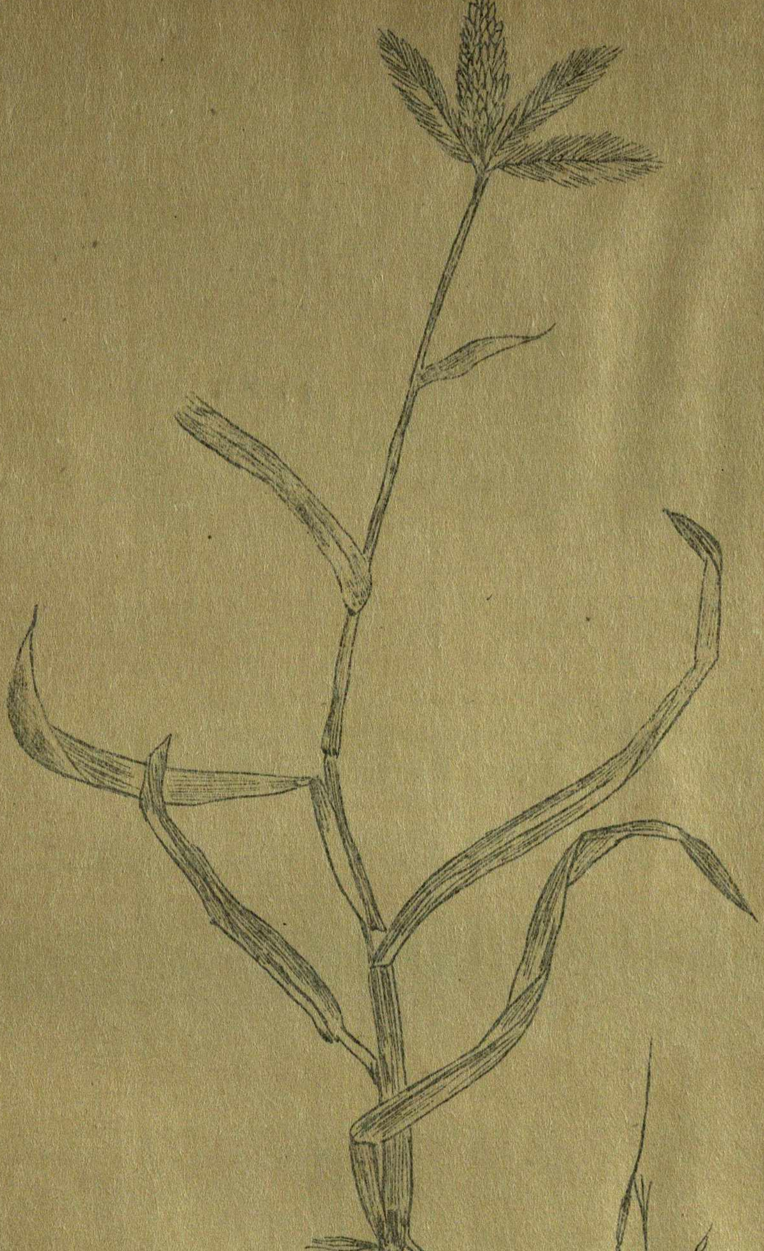

No. 61.

Eleusine Ægyptiaca, Pers.

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emarginate, its keel produced into a short awn. Flowering glume broad, acuminate or tapering into short points. Seed oval, somewhat 3-sided, rugose, enclosed in a thin loose pericarp.

Habit.—Common in Bombay and all over India, in Ceylon, Australia, Africa, and even in Europe. In poor hard soils it assumes a creeping habit, and yields short spikes. It is reckoned to be a good nutritious fodder; especially when young, cattle are fond of it. The seed is occasionally collected in some parts of India, and in times of scarcity eaten, but it is a poor unpalatable food.

This grass has a close affinity to the last described species. In fact, E. COROCANA is supposed, as already stated, to be the result of the cultivation of E. ÆGYPTIACA.

3. E. INDICA, Gaertn. Carp. I. 8; Kunth Enum. I. 272; Trin. Sp. Gram. X. 71; Roxb. Fl. Ind. I. 345; Dalz. and Gibs. Bomb. Fl.

Vern.—*Mendla* or *Medha*, *Guder*, *Khurd*, *Khurd-mendi*, *Malankur*, *Kuror* (Roxb.); *Mandwa*, *Thingri* (Royle); *Makraila*, *Gadha-charwa*, *Gadha-mandwi*, *Gurchawa*, *Mandanya*, *Kakaria*, *Mandial Jari*, *Gurra-gadi* (Duthie).

A coarse tufted grass. Culm erect, compressed, smooth, 1—2 ft. Sheaths flattened, distichous, sparsely hairy, chiefly at the mouth. Ligula short, hairy. Leaves glabrous, flat, linear, rather obtuse. Spikes 5—7, 2—3 in. long, secund, erect, digitate, often 1, occasionally 2, inserted at some distance below the others. Rachis prominent on the inner side. Spikelets 1½—2 lin. long, loosely imbricate on the opposite side, 3—5-flowered. The 2 lower glumes obtuse, 1-nerved, empty. Flowering glume usually 3-nerved. Seed oblong, obscurely 3-sided. Pericarp rugose, loose.

Habit.—It is common in Bombay and all over the Presidency in Bengal, N.-W. Provinces, and in Ceylon. Grows all over tropical and subtropical countries, Australia, Azores, Africa, America, Taiti, Guadaloupe, &c. It is a somewhat coarse grass, but the reports received are favourable to its being good fodder grass. It is eaten by cattle and horses. Is reckoned to be good fodder in Australia, in the United States of America, where it is known as *yard grass*, *crow's foot*, *crab grass*, and *wire grass*. Professor Phares says: "It grows in rich cultivated ground and produces immense quantity of seeds. It is very nutritious, and good for grazing, soiling, and hay. The succulent lower part of the stems covered with the sheaths of the leaves renders it difficult to cure well, for which several days are required. It may be cut two or three times, and yields a large quantity of hay." Report on the Agricultural Grasses of the United States. See also Duthie.

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Dr. Roxburgh says that cattle are not fond of it; this remark may, however, apply, according to Duthie, to the Bengal form, which the nature of the climate would render more rank and unpalatable. Mr. W. Fergusson of Ceylon also writes: "It is so coarse that cattle scarcely ever touch it. It is a most troublesome weed on road-sides, and will spring up from its roots after being cut down several times."

4. E. VERTICILLATA, Roxb. Fl. Ind. I. 346; CYNOSURUS VERTICILLATUS, LEPTOCHLOA VERTICILLATA, Kunth. Enum. I. 272.

Vern.—*Chihkhe* or *Kuri-Chinke, Kanjsi, Jama.*

Culm erect, smooth, 1—4 ft. high, terete, glabrous. Sheaths loose, flattened. Leaves bifarious. Panicle consists of 6—12 or more, sessile, secund spikes 1—3 in. long, the upper ones almost digitate, the lower distant or verticelled. Spikelets 2—3 lines long, numerous, imbricate, in 2 rows, 8—12-flowered. Lower empty glumes small and narrow. Flowering glume broad, 3-nerved, and ending into a short mucro or point. Seed oblong, enclosed in a rugose pericarp.

Habit.—It is a rare grass, though widely spread over India, and Africa, Australia, &c. It is considered to be a good fodder grass. I have before me specimens of this grass received from Bengal and N.-W. Provinces—none from this Presidency. Since this was written, specimens were received from Deesa sent by Mr. Westroff, Assistant Commissary General.

5. E. MUCRONATA, Willd. Enum. 1029; Steud. Syn. Pl. Glum. I. 112.

Vern.—*Gondi-Natchni, Katali, Gondwal* (Poona names).

Erect, simple, about ½ ft. high. Sheath hairy. Ligula short, ciliate. Leaves flat, tapering to a fine point, ciliate. Spikes digitate, 3—5, often reduced to 1, secund, about ¾ of an in. long or shorter. Rachis terminated in a distinct mucro. Spikelets numerous, densely imbricate, arising from the lower or outer part of the rachis, 5—3-flowered. Flowering glume tapering into a short mucroniform point; keel sparsely ciliate.

Habit.—It is a short species, producing often 1 spike only. Specimens received from Khándesh, Násik and Poona. Very common in some places of the latter district. It has a close affinity to E. ÆGYPTIACA, if not the same species. I have described it, because there is a specimen thus named by the late General Munro and kept in the Herbarium of the Poona College of Science.

6. E. FLAGELLIFERA, Nees, in Royle's Herb.; E. ARABICA, Hochst., Steud. Syn. Pl. Glum. I. 211; E. STOLONIFERA, R. Br. Prod

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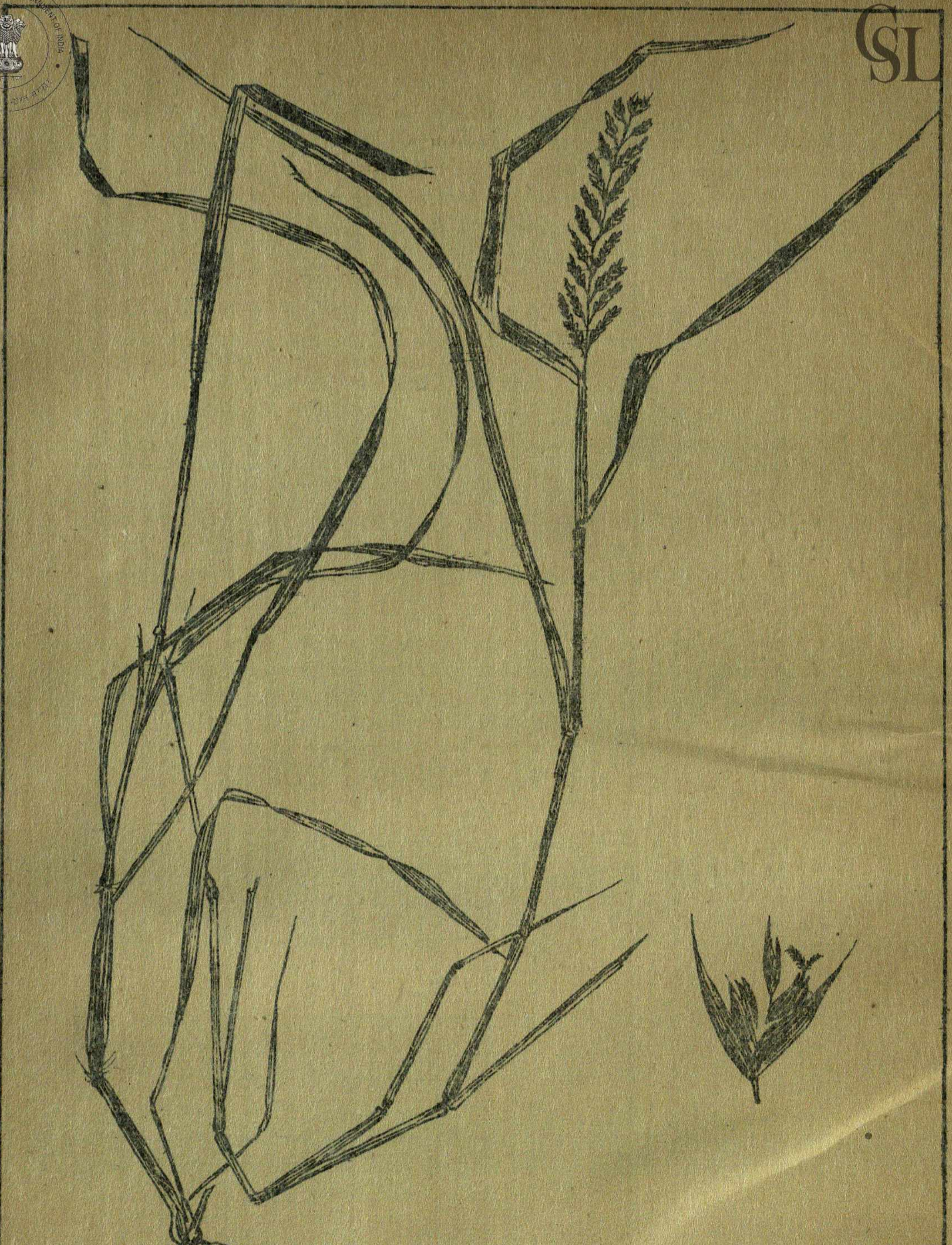

No. 63. *Dinebra Arabica, Beauv*

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Vern.—*Veli, Daundi, Chimbar, Ganthia, Ganth dob, Gurdub,* (Royle), *Chubrei, Bharu, Chembar, Gathil, Karimbor Dubra* (Duthie)

Perennial. The whole plant is glaucous. Culms many, creeping and arising from the bulb-like rooting nodes. The base covered with dry sheaths. These ciliate at the mouth. Leaves narrow, linear, lanceolate, acuminate, rigid, distant, upper very short. Spikes 2—5, 6—7 lin. long, digitate, loose, imbricate, 5—8-flowered. Glumes lanceolate, obtuse, the flowering one acute. This grass lies prostrate over the ground and creeps over more than 2 feet.

Habit.—Not uncommon on hard and arid soil in Poona and W. Khandesh, where it is considered to be good fodder for cattle and horses. In N. India it is also valued as a good fodder.

7. E. SCINDICA, Duthie, Fodder Grass of India, 58; DACTYLOCTENIUM SCINDICUM, Boissier.

Vern.—*Mandjiro, Bhobra, Bobriya, Ganthia, Ganti-grass, Jangli Malicha, Kakro-Makro.*

Perennial. Culm creeping and rooting at the lower rather thickened nodes. Flowering stem long, slender, erect, naked at the upper part, 2—2½ ft. long. Leaves short, acuminate, flat, edges ciliate at the base. Spikes 3—5 in., digitate, 4—5 lin. long, slightly curved, rather thick, secund. Rachis mucronate. The 2 lower glumes empty, the lowermost acute, the upper larger and produced into a short oblique mucro. Flowering glume oblong, acute, its scabrid keel ending into a short mucro.

Habit.—This slender grass grows in the plains of N.-W. India and Aden. It is reckoned to be a good fodder grass.

62. DINEBRA, Jacq.

Spikelets 2—3-flowered, hermaphrodite, arranged in 2 rows on short, numerous, unilateral spikes finally reflexed. Lower 2 glumes empty, narrow, keeled, ending in more or less long points. Flowering glume short or mutic.

Species one (the following) in India and in tropical and Northern Africa.

1. D. ARABICA, Beauv. t. 16, fig. 2.

Vern.—*Baria, Kali-kauli, Bara sarpot*; *Waddata-toka, Jaddee* (Roxb.).

Culm decumbent or erect, 1—3 ft. high, leafy at the base. Leaves thinly sprinkled with hairs. Panicle erect, 8—12 in. long,

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composed of numerous, short, alternate, sessile spikes, at first erect, and reddish when young, then reflexed. Outer glumes equal, longer than the flowering glume. It is said to be introduced in Ceylon.

Habit.—Reports from Khándesh and Poona say that it is good fodder for grazing and perhaps for stacking. Report from Nirgudi (Poona)—"good fodder, especially for milk cows." During the rainy season this grass is sold along with other fodder grasses. Mr. Duthie thinks that "it is probably nutritious, but being only an annual and not plentiful, it does not take a high place as a fodder grass." Dalz. and Gibs., Bomb. Fl., p. 297, say: "It is common in Sind, where it is called *Drub*, and it is a favourite food of buffaloes."

63. LEPTOCHLOA, Beauv.

Spikelets 2 or more, flowers awnless, attached to one side of numerous slender branches of a long panicle. Glumes keeled, 2 lower ones empty, persistent. Flowering glume rarely awned, awn small.

Species about 12 in the tropics of both hemispheres.

1. L. CHINENSIS, Nees, Agrost. Bras., 432; Steud. Syn. Pl. Glum. I. 209; L. TENERRIMA, Roem. and Schult.; POA DECIPIENS, Steud., Synop. Pl. Glum. I. 279.

Vern.—*Chenhel*, *Jhira*, *Phulkia*.

Culm creeping and rooting from the lower nodes, then ascending 2—3 ft., ramous, usually slender, glabrous. Leaves linear, scabrous, produced into a point. Panicle 1 ft. long or longer, very ramous. Branches numerous, slender, simple, scattered or clustered along the rachis, 2—4 in. long. Spikelets alternate sessile, shortly pedicelled, distant or approximated, narrow, 1—2 lines long, 4—6-flowered. The 2 lower glumes empty, somewhat unequal, lanceolate, acute or subulate. Flowering glumes broader and obtuse, hyaline at the apex.

Habit.—Seen specimens collected in Parel (Island of Bombay) and Gujarát. Said to be common in the plains of N. India, where it is used "more or less for fodder." Also in Bengal, Ceylon, and Australia.

Tribe X.—FESTUCEÆ.

Spikelets 2—many-flowered, rarely 1-flowered, usually hermaphrodite, in spikes or racemes. Rachilla articulate above the 2 lower glumes, which are empty and shorter than the flowering glumes, all awnless, or with one or many awns, usually terminal, rarely dorsal, straight, very rarely bent.

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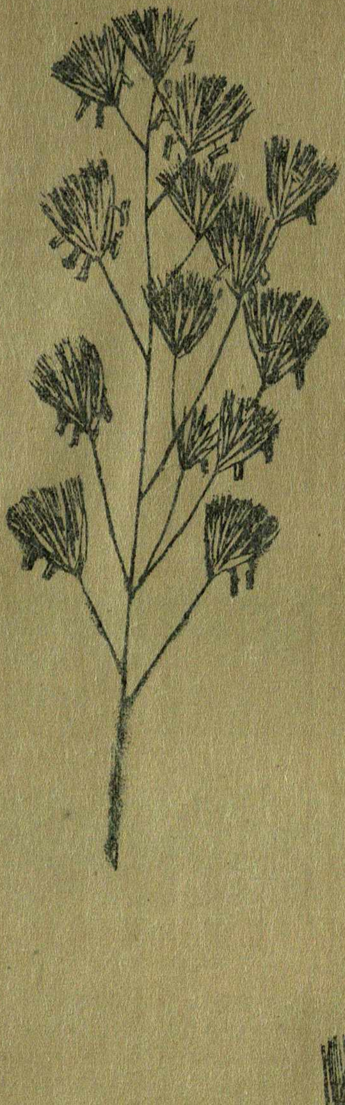

N-64

Arundo Donax, Linn.

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Species many in the temperate zone, as well as in the high mountains in the tropics.

This large order is divided into 70 genera, distributed in sub-tribes.

(1) BOISSIERA, Hochst.

Spikelets 2—3-flowered in short dense panicles. Outer 2 glumes empty, thin, acute, end in long awn-like processes; 2nd glume longer than the 1st, 5-nerved. Flowering glume convolute around the flower, hyaline and lobate at the apex; with 5—9 dorsal straight awns. Upper glumes many empty gradually smaller. Palea included in the flowering glumes. Stamens 3. Styles very short dilated, shortly bifid and penicillate.

Species only one.

(2) BROMOIDES, Jaub. and Spach. Ill. Pl. or I. 197.

A small annual plant. Culm filiform 2—6 in. high. Sheaths 6 lin.—1 in. Ligula small, hyaline, lacerated. Leaves 1—2½ in. long and 1 or 2 lines broad. Panicle contracted, 1—2 in. long, dense. Caryopsis linear, furrowed in front, and free in the glume. It resembles BROMUS, and also approaches PAPPOPHOREÆ.

Grows in Arabia and Sind. Collected in Kojak Pass by Mr. H. E. M. James.

64. **ARUNDO**, Linn.

Tall grasses, leaves flat. Spikelets 2—many-flowered. Rachilla articulate between flowers. Flowering glumes 2-toothed, clothed with long hairs, and a cuspidate point between the teeth. Caryopsis oblong, free in the glume and palea.

Species 6, distributed over the tropical countries.

1. A. DONAX, Linn.

This tall and beautiful grass and its varieties are extensively cultivated in gardens all over India. Common in the south of Europe, in the region bordered by the Mediterranean Sea, and in East Asia. It may be said to be a classical plant, as its culm was first used in the manufacture of musical instruments, during the bucolick times, when man entirely or chiefly led a pastoral life. The pipes, or flute of Pan, of 7 tubes, the invention of which is lost in the mists of antiquity, was made of the culm of this plant. Virgil, in chanting the praises of Varus, speaks of this plant thus:—

Agrestem tenui meditabor arundine musam.

And in another place we read that this reed furnished the arrow—

Utquo levi Zephyro gracilis vibratur arundo.

MINISTRY OF CULTURE GOVERNMENT OF INDIA
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The plant is now used for the support of vines and other climbing plants, and also for many domestic purposes, walking sticks, fishing and measuring rods being made of it and also musical pipes. The reed often mentioned in the Bible is believed to be the culm of this plant or of the following species. Both are common in Palestine. The leaves are eaten by cattle.

There is a variety cultivated in our garden, which has broad leaves, striped with longitudinal white bands.

65. PHRAGMITES, Trin.

Spikelets 3-or more-flowered, pedicellate in a large panicle; the rachis of the spike produced above the flowering glumes which are clothed with long hairs; these do not arise from them. Glumes keeled, 2 lower ones empty, acute or pointed, the 3rd with a longer point and a male or rudimentary flower in the axil, the others distant; the terminal one a rudimentary glume.

The species below described are varieties of P. COMMUNIS.

1. P. KARKA, Trin.

Vern.—*Deonal*, or *Deonál*, *Nal* (Roxb.), *Karka* (Watt), *Naga-Sava*, *Patoo-ederoo* (Teling, Roxb.), *Nuda-nar*, *Narkut*, *Narkat*, *Narsal Nar*, *Naria*, *Nai* (Steward, Duthie).

Culm erect, stout, perennial, piped, 6—12 ft. high, covered with the leaf sheaths up to the inflorescence. Leaves lanceolate, in luxuriant plants 12—20 ft. long, and about 1 in. broad, margins scabrous. Panicle loose, $1—1\frac{1}{2}$ ft. long, erect, composed of numerous filiform, scabrous branches, generally of a purplish-brown colour. Spikelets numerous, crowded, flowers 3—5 in each, Glumes oblong, lanceolate, 4—5 lin. long. Inferior flower male. its flowering glume linear, subulate. Superior flowers hermaphrodite. Glumes glabrous, but they are covered with long silky hairs from the rachis.

2. P. ANGUSTIFOLIA, P. NEPALENSIS, Nees, and ARUNDO BIFARIA, Retz., appear to be varieties of P. COMMUNIS.

Habit.—They grow all over India; in this Presidency, but rare, occurs chiefly near the margins of rivers and lakes. I have before me at present specimens received from Dhund. The creeping root is very long, often measuring several feet. The large panicles, when dry, form an ornament for vases for the drawing room, &c. Pipes are made of the culms, particularly those used by snake charmers. The common *Durma* mats of Bengal are made of the stalks split open. Vessels from the port of Calcutta are generally dunnaged with them. Roxb.

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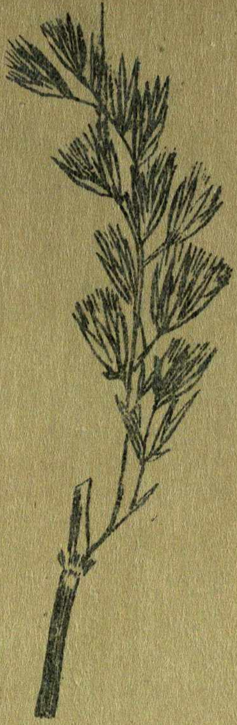

NO. 65

Phragmites Karka, Trin.

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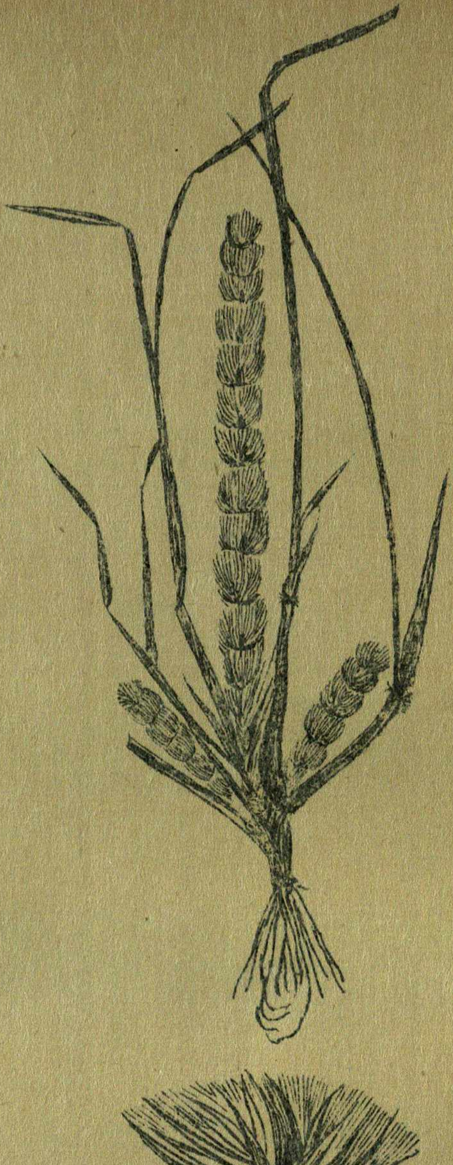

Fig 1.

Elytrophorus articulatus, Beauv.

DRAWN FROM NATURE.

No. 66.

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P. COMMUNIS has a very extensive range.

> From the hollow reeds he fashioned
> Flutes so musical and mellow,
> That the brook, the Sebowisha,
> Ceased to murmur in the woodland,
> That the woodbirds ceased from singing,
> And the squirrel, Adjidaumo,
> Ceased his clatter on the oak-tree,
> And the rabbit, the Wabasso,
> Sat upright to look and listen.
>
> LONGFELLOW's "Hiawatha."

66. ELYTROPHORUS, Beauv.

Contains a single species easily recognized by its inflorescence minutely described below.

1. E. ARTICULATUS, Beauv. Agr. 14, fig. 2; Dalz. and Gibs. Bomb. Fl. 316; DACTYLIS SPICATA, Willd. in Nov. Act. iii. 415; ECHINALYSIUM STRICTUM, Trin. Fund. 142.

Vern.—*Kemshi, Jungli Rala* (small seed); *Chimansar, Poshe, Suria, Ket kapuri, Balha Kolhati*

An erect glabrous annual 6 in.—1 ft. high, including the inflorescence. Sheaths loose. Leaves flat, longer than the culm. Inflorescence a green cylindrical spike 1—6 in. long, consisting of numerous small, flat, few-flowered (3—7-flowered), sessile spikelets, disposed in dense globular clusters, crowded so as to form one continuous spike or the lower clusters distant. The inflorescence is often shortly branched at the base. The lower 2 glumes empty, membranous, narrow, keeled, shortly awned or pointed, subequal, about 1 line long, without the awn. Flowering glumes 3-nerved, tapering into awns, which are as long or longer than the glume. Palea folded, with one or two dorsal wings. Stamen one. Grain ovoid oblong.

Habit.—Found throughout India, Australia, and Africa. Grows near water-courses and in rice fields, looks like SETARIA SPICATA from a distance.

Uses not known.

67. ERAGROSTIS, Beauv.

Spikelets many, laterally compressed, awnless, arranged in panicle. Rachilla and usually also the paleæ remaining after the flowering glumes and the fruit have fallen. Glumes distichous, the 2 lower ones empty, unequal or subequal; 1—3-nerved. Flowering glumes usually 3-nerved, awnless, rarely mucronate. Palea prominently 2-ribbed, persistent. Caryopsis globose or ovoid unfurrowed.

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Species about one hundred, dispersed throughout the warm regions.

This large order is natural if we limit the species to 3-nerved glumes. It is divided into 6 sections :—

(1) Cataclostos.—Rachilla articulate, spikelets small, flowering glumes membranaceous. E. ciliaris, Link., is cosmopolitan throughout warm regions, common in India.

(2) Plagiostachia.—Rachilla articulate, spikelets large, flat, several flowered, flowering glumes coriaceous. The species are rather dissimilar in habit. E. bifaria, Steud., has a single long terminal spike, nearly of Tripogons. E. cœlachrium, Benth., has nearly the habit of Dactylocenium or of Æluropus.

(3) Myriostachia contains one species, an East Indian, named E. Wightiana (Leptochloa Wightiana, Nees) allied to E. cynosuroides, but with a more complicated inflorescence, and long-awned empty glumes.

(4) Pteroessa (Megostachia).—Many-flowered spikelets, rachilla and usually also the palea remaining after the flowering glumes and the fruit have fallen. E. Pilosa, cosmopolitan species common in India, and its allies belong to this section. E. Abyssinia, Link., is an important food plant in Abyssinia. Flour made from its seeds is baked into bread. This species is supposed to be a cultivated form of the last species.

(5) Platystachya.—Rachilla articulate as in Cataclostos; spikelets large and flat, like those of Brisa, and flowering glumes coriaceous. Species are African and Arabian.

(6) Sclerostachya.—Articulate rachilla and coriaceous glumes are like those of Platystachya, but the spikelets not so broad, and the leaves rigid and pungent. Contains 3 African and Asiatic species.

1. E. aspera, Nees, Fl. Afr. Austr., 408; Poa aspera, Jacq. Host. Vind. III. 56; Lam. Ill. I. 185; Poa paniculata? Roxb. Fl. Ind. I. 340.

Culm erect, smooth, 3—5 ft. Sheaths with long white hairs at the mouth. Ligula ciliated. Leaves in the specimens before me are 2—3 lines, broad at the base, soon becoming very narrow and pointed. Panicle very large. Branches numerous, spreading, filiform, generally alternate, their insertions covered with rather long white hairs. Spikelets linear, oblong, 1½ lines, on very long peduncles, 8—10-flowered (Roxb.'s Poa paniculata, 4—16-flowered). Peduncles scabrous. Glumes acute, nearly equal. Flowering glume distinctly 3-nerved.

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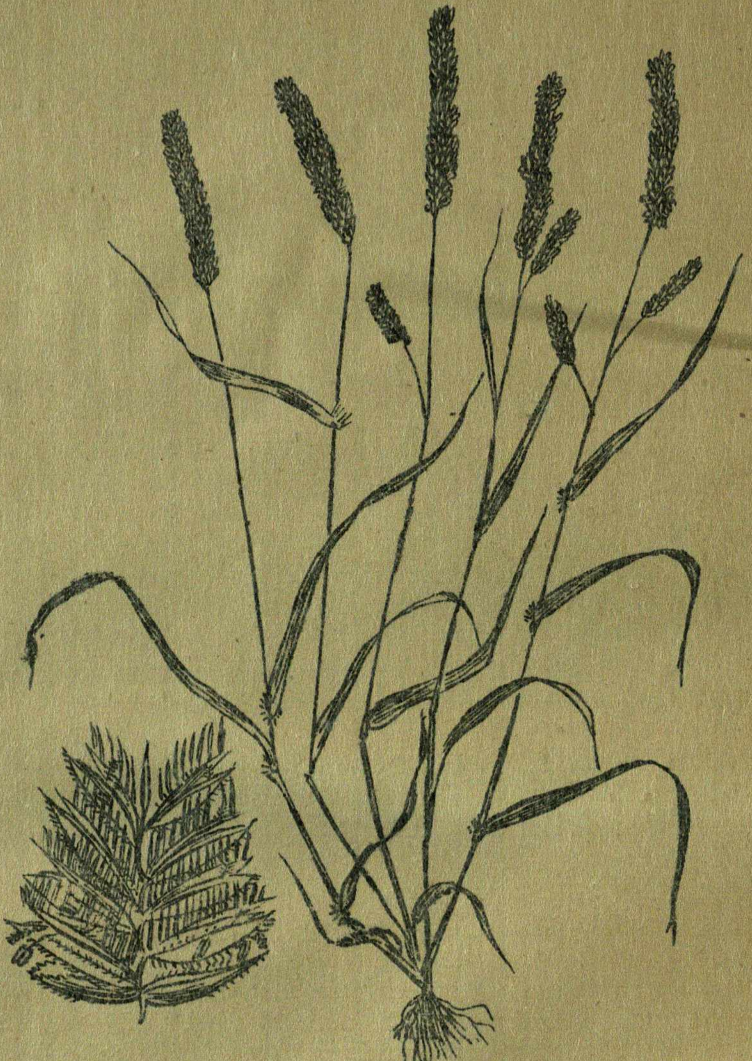

No. 67 Eragrostis brachystachya, Jaub. and Spach.

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Habit.—Rare in India. Is distributed throughout tropical Africa, S. Africa, Abyssinia, and the Isle of France. My specimens are from N. Kánara. Uses not known.

2. E. CILIARIS, Link.; POA CILIARIS, Linn.; P. CILIATA, Roxb. Flor. Ind. I. 336.

Vern.—*Undar-puncho, Tor Chandbol* (Campbell), *Burbudi.*

Culms erect, rigid, procumbent below, 3 in.—1 ft. Leaves narrow, linear, pubescent at the insertion into the sheath. Panicle narrow, spike-like, occasionally branched from below. Spikelets 5—8, sometimes more-flowered. Glumes acute. Flowering glume distinctly 3-nerved, cuspidate, ciliate at the margins. Palea with long, white, stiff hairs. Seed obovate, globose, smooth, dark-coloured.

Habit.—Grows all over India and in Arabia in sandy soil. Common in Poona, Damaun, Domus, Gujarát, Nágpur, Kámpti, &c.

3. E. BRACHYSTACHYA, E. ARABICA, Jaub. and Spach. t. 322.

This is a variety of the last and grows in the same localities. The inflorescence consists of a dense cylindrical spike, resembling that of ÆLUROPUS LAGOPODOIDES.

Habit.—I have gathered specimens, some very small, not longer than 1 in. on the polo ground, Poona.

Eaten by cattle.

4. E. TENELLA, Beauv. Benth. Fl. Honk. 431; POA TENELLA, Linn., R. Br. Prod. 181; Roxb. Fl. Ind. I. 337.

Vern.—*Dhooria, Bharbhuri, Mondiajori, Ichcoi* (Campbell).

Tufted annual. Culm erect, smooth, 6 in. to 2 ft. high. Leaves flat, narrow, pointed towards the end, smooth, glabrous, rather scabrous at the margins. Panicle very long and narrow, occupying the greater part of the plant; branches numerous, filiform, usually much divided, ascending, or the lower ones verticillate or in clusters. Spikelets pedicellate, numerous, very small, ovate, 3—4 rarely 6-flowered, often tinged red. Glumes thin almost hyaline, obtuse, loosely imbricate, rachis articulate; palea glabrous. Seed oval, brown, smooth.

Habit.—Grows all over India. Not common in this Presidency. While writing these notes, I have before me specimens from the cultivated ground in Bassein. It is said to be good fodder, much appreciated in Australia. Mr. Duthie says “common in the plains of N. India, specially in cultivated ground along with *sugar-cane, juár* and *arhar.*" Eaten by cattle both fresh and dry.

5. E. PLUMOSA, Link.

Vern.—*Dhane, Chirika khet, Chirika-bajro, Bharbhuri, Bharbusi, Bara Churbhura.*

Culms filiform, ramous, round, glabrous, erect, from 1—2 ft. Sheaths pilose at the mouth. Leaves linear-acute. Panicle ovate-oblong or somewhat pyramidal, diffuse. Branches many, ramous, alternate, horizontal, with a few short hairs at the axils. Spikelets minute, lax, pedicelled, dependent, from 4—7-flowered. Pedicels much longer than the spikelets. Lower glume smooth, glabrous. Flowering glume obliquely truncate, with hairs on the dorsum. Palea ciliate with spreading hairs; seed oblong, smooth, brown.

Habit.—Common in Bombay, Konkan, and along the coast, in the plains of N. India, especially on the sandy soils; it is also abundant on saline *usar* soil in company with the *usar* grass (SPOROBOLUS ORIENTALIS). Said also to be common in Ceylon, in the warmer parts of the island.

The panicles of this grass present various forms; they are in some varieties so narrow and contracted as hardly to be distinguished from E. CILIARIS, Link. In Allahabad it grows well along with *dub* and makes useful light hay for mixing with coarser hay eaten both by horses and cattle. In Ajmere it is also considered to be a good fodder. In Bombay it is eaten by cattle when young.

6. E. STENOPHYLLA, Hochst.

Vern.—*Fulia, Chikta, Chimanchara, Choti khidi, Jenkua, Khari.*

Culm usually 6 in.—1 ft. or longer, glabrous. Sheaths sometimes with a few cilia at the mouth. Leaves glabrous, narrow, flat, or convolute. Panicle very variable, sometimes quite simple, and with dense spike-like branches, or with long distant spreading branches. Spikelets very shortly pedicelled, flat, very small, tapering to a point. 10—20-flowered (10—40-flowered, Benth.). Flowering glumes closely distichous, glabrous, their lateral nerves distinct. Grain ovoid, oblong, smooth. Spikelets darkish in colour or pale.

Habit.—Found all over Bombay, plains of N.-W. India and at lower elevations on the Himalayas. It is said to grow in Ceylon

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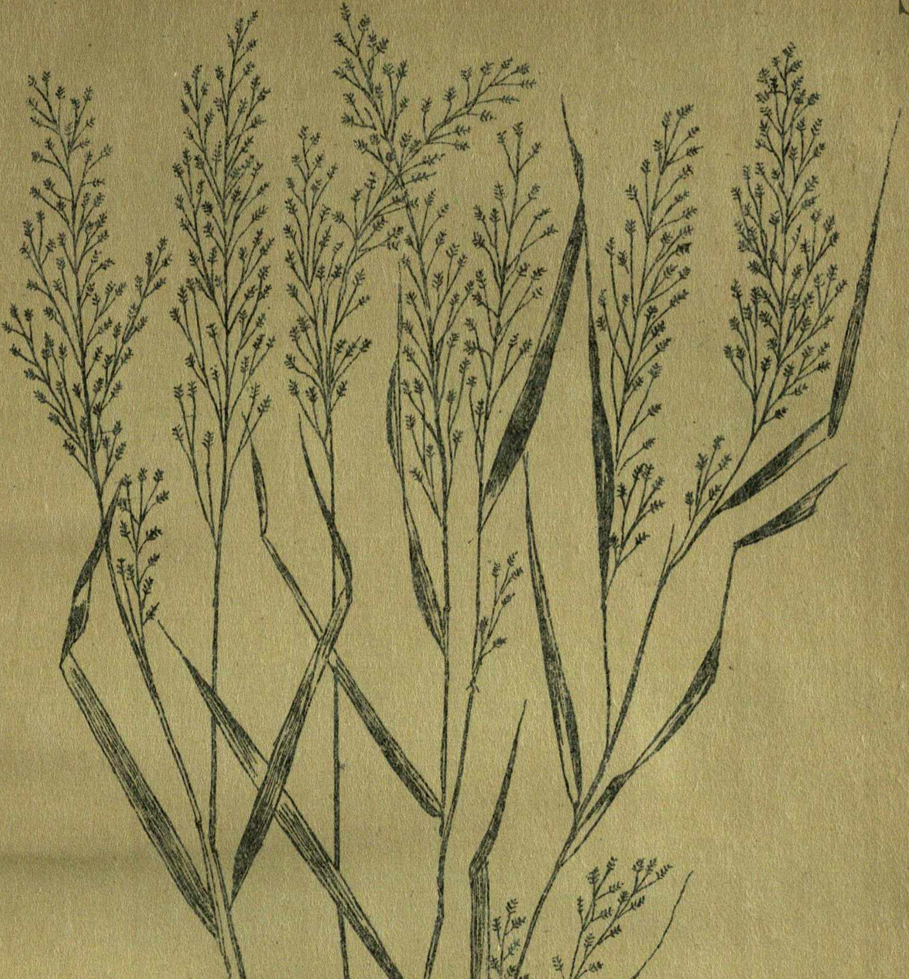

No. 68 *Eragrostis plumosa, Link.* DRAWN FROM NATURE.

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and also in Australia. In the latter country it is considered to be a good pasture grass, yielding an abundance of feed both in Winter and Summer.

7. E. ELEGANTULA, Nees, Steud. Syn. Pl. Glum. I. 266; POA ELEGANTULA, Kunth. Enum. Pl. I. 346; POA ELEGANS, Roxb. Fl. Ind. I. 339.

Vern.—*Todha, Asara, Chota Asara, Kaluargi.*

Culm erect, simple, round, ascending, 1—4 ft. high. Sheath glabrous, except at the mouth. Leaves few, short, glabrous. Panicle oblong, nodding. Branches solitary, rather distant, appressed. Spikelets pedicelled, 8—12-flowered, linear, of a purplish colour. Flowering glume 3-nerved, nerves distinct. Grain globular, smooth and brown.

Habit.—A very elegant tall species, found in wet ground in Sálsette, Khándesh and Poona. Also not uncommon in the plains of N. W. India. Eaten by cattle either fresh or dry. From Poona it is reported "to be good fodder, but rare."

8. E. VISCOSA, Trin., reduced to a variety of E. TENELLA, N. & S.

Vern.—*Bhurbur, Bhurbusi, Chikti, Bhulni, Chipal* (Duthie).

Culm ascending, cespitose, 9—19 in. long, viscid. Sheaths glabrous, mouth clothed with long white hairs, as also the ligula. Leaves short, narrow, tapering to a point, usually glabrous. Panicle linear, oblong or thyrsiform, 2—5 in. long. Branches short, verticillate, spreading. Spikelets oblong, very shortly pedicelled, 6—20-flowered. Upper glume most frequently ciliated. The whole plant, especially the inflorescence, is covered with a viscid substance having a balsamic odour.

Habit.—I have collected it at Chaupáti and Malabár Hill (Bombay). Grows also in the plains of N. India on sandy soils often accompanying E. PLUMOSA, and probably of equal value for fodder purposes.

9. E. INTERRUPTA, Beauv. Agrost. 71.

Vern.—*Pohe, Poche, Dhooria* (Bassein name), *Ghodila, Ghorila* (Teling name *Nakurmaral* and *Urenke*, Roxb.), *Chiksi* (Khardi), *Madra* (Khardi, Thána), *Shetpatra* (Bhivandi, Thána).

Culms single, erect, glabrous, 3—5 ft. Leaves narrow, long, scabrous. Panicle linear-contracted, 1—2 ft.; branches filiform, solitary, or two or more from nearly the same place, giving the panicle a verticillate appearance; lower branches are often distant.

Spikelets pedicelled, smooth, glabrous, often tinged red, 8—14-flowered. Seed oblong.

Habit.—A tall species with beautiful long drooping panicles, often of purple-coloured spikelets, growing in large quantities in good, moist soil near the banks of rivers and streams, in water holes, and borders of rice-fields all over India and Ceylon. Not reckoned to be good fodder. Cattle eat it when other food is not available. Report from Kháudesh says that it is good fodder for buffaloes.

10. E. AMABILIS, W. and A.

Vern.—*Poi, Poke, Moti chava, Chota loniya* and *Loniya, Konee* (Bengal, R.).

Culm slightly decumbent at the base, ascending 1—2 ft. high, ramous, round, smooth, glabrous. Mouth of the sheath bearded. Ligula very small. Leaves short, linear, lanceolate. Panicle ovate, oblong, half the length of the plant or longer, dense, erect, ramous. Branches filiform, short, horizontal, fascicled below, solitary above. Pedicels long, very slender. Spikelets flat, ovate, 16—20-flowered, white or with a bluish-purple tinge. Flowering glume 3-nerved, nerves distinct. Grain oblong and smooth.

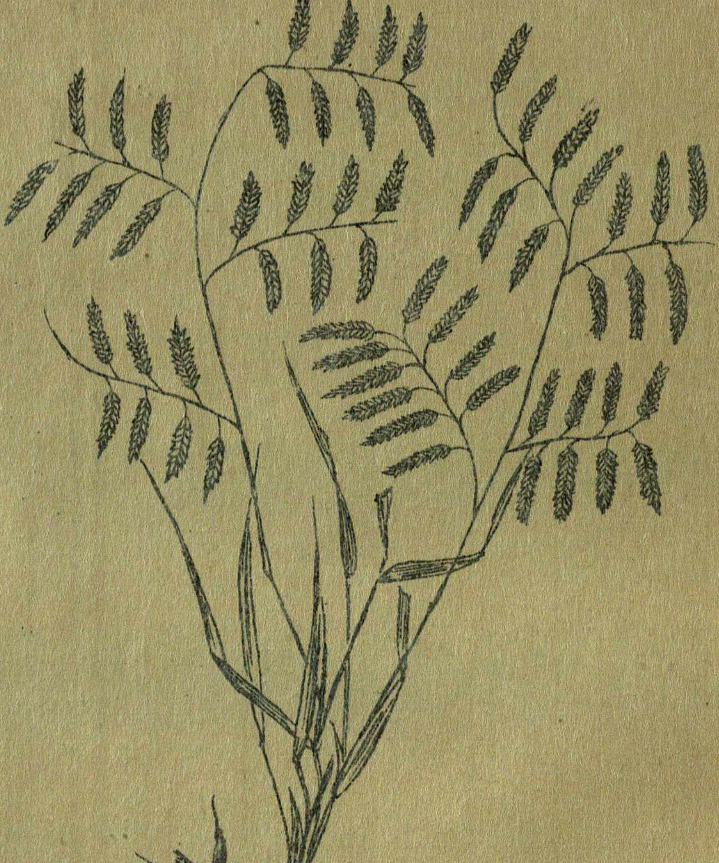
Habit.—Common in India, up to 5,000 ft. on the Himálayas, usually on wet ground. Also in Ceylon. When growing on the banks of streams or on wet places, it is a very handsome grass. Graham in his Catalogue of Bombay Plants, p. 236, calls it "the most elegant of all the grasses." Report from Shapur says that it is used there as good grass for horses and cattle.

11. E. TREMULA, Hochst., Herb.; POA TREMULA, Lain. Ill. I., 185; P. MULTIFLORA, Roxb. Fl. Ind. I. 139; ERAGROSTIS MULTIFLORA, Dalz. and Gibs. Bomb. Fl. 298.

Vern.—*Chiraka, Chirika ket, Chirika chauvalia, Kalunji* (Royle).

Culm sub-erect, round, smooth, 6—18 in. high or higher. Sheaths sparsely pilose at the margins and the mouth. Ligula very minute, ciliate. Leaves short, few, mostly from the base, narrow and tapering to a fine point. Panicle longer than the rest of the plant, oblong, bending, many branched, lax; branches thin, pilose at the axils. Pedicels capillary, equalling or longer than the spikelets. Spikelets linear, very long, obtuse, many-flowered, nodding. Flowering glume ovate, obtuse, 3-nerved; nerves distinct, the median prominent. Grain round, smooth.

Habit.—Near Gogha, on the Káthiáwár Coast, Lonávla on the left of the road leading to Poona, and on other dry elevated places.



No. 59

Eragrostis major, Host.

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GSL

Not used on this side; its foliage is too scanty to be of much value. Considered to be good fodder in Ajmere. "Its grain is said to have been extensively utilised by the starving population in certain parts of the Punjab during a famine which took place about 60 years ago, and which is even now remembered as the *lukkiwala sál*" (Duthie). The very slender pedicels, which support the long spikelets, give rise to the constant tremulous motion exhibited by this species when in flower.

12. E. MAJOR, Host. Gram. IV. t. 24; MAGASTACHYA ERAGROSTIS, Beauv. Agrost. 14; POA MEGASTACHYA, Koel. Gram. 181.

Vern.—*Ran Pohe, Phole* (Goa name), *Pohe, Kaodia, Chiriyake chaolay* (Royle).

Culms ascending or erect. Sheaths pilose at the mouth. Leaves narrow, linear. Panicle large, ovate-oblong, inferior branches pilose at their origin. Pedicels shorter than the spikelets. Spikelets large, flat, linear oblong, solitary or in clusters, 15—20-flowered. Flowering glume shortly mucronate; lateral nerves prominent.

Habit.—Common throughout the Bombay Presidency and the plains of N. India; up to 5,000 ft. on the Himalaya. Mr. Duthie states that it is used more or less as fodder, but in this Presidency it is not used as such.

13. E. MINOR, Host., E. POÆOIDES, Beauv., t. XIV. fig. 11; Roem. and Schult., 11. 574; POA ERAGROSTIS, Linn., Sp. 100.

Vern.—*Sul.*

Culm erect or ascending, ramous, $\frac{1}{2}$—2 ft. high or higher. Sheaths glabrous or minutely pilose, leaves lanceolate, acute. Panicle not large; branches expanding, solitary or 2 together, with or without hairs at their origin. Spikelets linear-lanceolate, 8—20-flowered. Glumes obtuse. Flowering glumes with prominent lateral nerves.

Habit.—My specimens are from Násik, where it grows in *khár* lands and has to be weeded out, or it destroys the rice plant. Grows also in the plains of N. India and up to 8,000 ft. on the Himálaya. Uses not known.

14. E. PILOSA, Beauv.

Vern.—*Burwai, Chiriaka-dana, Kutaki.*

Culms slender, ascending, 1—2 ft. Sheaths shortly pilose at the mouth. Leaves flat, narrow, linear, acuminate. Panicle 6 in. —1 ft.; branches numerous, capillary, at first appressed, afterwards

GSL

(when in fruit) spreading. Pedicels longer than the spikelets. Spikelets minute, 2—4 lin. long, linear, the lower in verticels, 6—11-flowered, often tinged with purple. Glumes thin, keeled, the lateral nerves obscure. Flowering glume glabrous. Palea obscurely ciliate. Grain ovoid, oblong.

Habit.—In W. Khándesh, Poona and Násik, also in the plains of N. India, usually in damp and swampy ground, where it is relished by buffaloes. In Khándesh, Poona, Násik and Ajmere, and in Australia it is considered to be a good fodder. This grass is also very common in Ceylon.

15. E. CYNOSUROIDES, Roem. and Schult. Syst. II. 577; Dalz. and Gibs. Bomb. Fl. 298; POA CYNOSUROIDES, Retz. Obs. IV. 20; Roxb. Fl. Ind. I. 334.

Vern.—*Darbha, Dab, Dhab,* or *Dib, Kussa, Koosha, Drab, Dabvi, Durper.*

Perennial, with a thick creeping root. Culm thick, reed-like, terete, covered at the base with withered sheaths of leaves. Sheaths glabrous. Ligula ciliate. Leaves rigid, flat, the young root-leaves convoluted, 4—8 in. to 1 ft. long, acute, hispid, especially at the margins. Panicle spike-like or conical, elongated, ½—2 ft. long; branches numerous, dense, racemose, horizontal, short, rigid. Spikelets sessile, secund, in 2 rows, from the under side of each branch, distichous, 6—12-flowered. Flowering glume ovate, lanceolate, obsoletely nerved.

Habit.—In Gujarát, W. Khándesh, Násik, also in the plains of N. India in all kinds of soils, especially in places where water collects; its long vigorous rhizome-like roots serve to keep it fresh even in dry weather. It is said to be eaten by buffaloes; as a rule, cattle do not eat it. When in flower it is considered to be an indifferent kind of fodder. When other kinds of fodder are wanting, it is often given mixed with gram and wheat. It is stated that its strong fibres are used in N. India for the ropes of the Persian wheel, where they will last for three months or more. The fibres are also used in some parts of Gujarát to make a sort of coarse paper.

This grass is employed by the Bráhmins in their religious ceremonies. Kussa, the Sanskrit name of this much-venerated grass, was given to it at a very early period by the Hindu philosophers, and believed by Sir William Jones to have been consecrated to the memory of *Cush*, one of the sons of Ram (Roxb.). It is enjoined in the Shrávan Purán that the Dharb should be collected or rather pulled out of the ground on *Pithori Anváshya*. Only plants thus collected are fit for use in religious ceremonies. They

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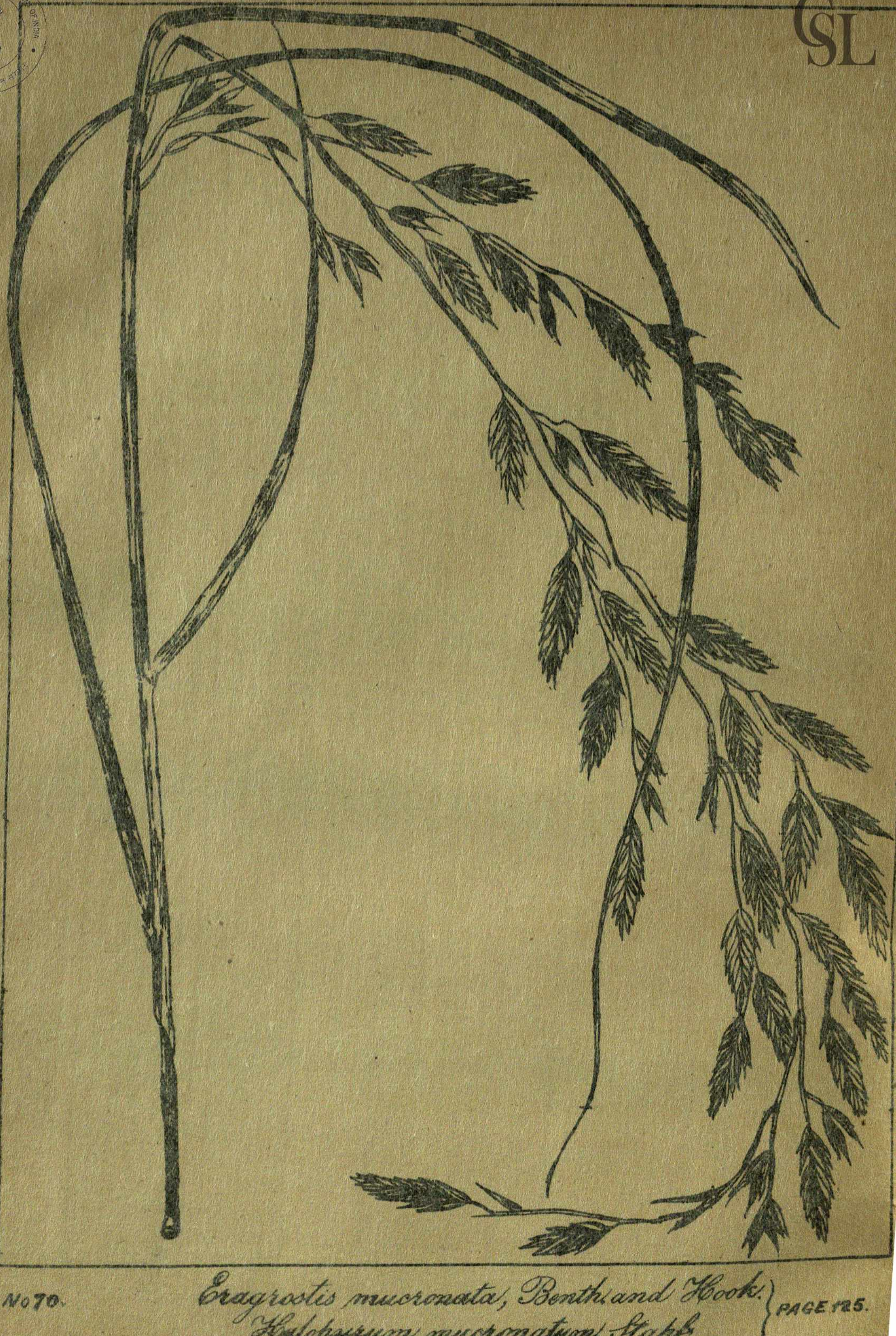

No 70. Eragrostis mucronata, Benth. and Hook.
Halopyrum mucronatum, Stapf } PAGE 125.

are also employed in various funeral ceremonies, such as *tarpan.* It is often spread beneath the dead bodies, the chief mourner wearing a ring of it on his finger.

An infusion of the root is used as a diuretic.

16. E. BIFARIA, W. and A.; Steud. Syn. Pl. Glum. I. 264; E. SECUNDA, Nees; POA BIFARIA, Vahl. Symb. II. 19; Roxb. Fl. Ind., I. 333.

Vern.—*Chiraka*, *Punya-sufed*, and *Chota blankta*, *Moi*, *Woodatallum* (Roxb.)

Culms erect, simple, wiry, glabrous, 1—2 ft. Sheaths keeled. Leaves narrow, carinate, complicate, rigid, glaucous, glabrous. Spike simple, terminal, straight, 4—8 in. long. Spikelets sessile, alternate, linear-lanceolate, compressed, secund, in 2 rows, upper many-flowered, the lower ones 4—6-flowered.

Habit.—In Poona, Bhusával, Páchora, and in other dry places. Said to be used as good fodder in Poona. In Bhusával it is not known as fodder. This species grows also in sandy and rocky ground in N.-W. India, common in Rájputána. At Ajmere it is considered to be a good fodder grass, and is eaten by cattle on Mt. Aboo. In Ceylon it is not uncommon up to an elevation of 5,000 ft.

It has a close affinity to E. COROMANDELIANA, Trin., found growing in Coromandel.

17. E. MINUTIFLORA, Presl. in Rel. Haenk; POA BIFLORA, Retz. Obs. V. 19; Kunth. Enum. I. 363.

Culm erect or ascending, striated, glabrous, rather scabrous, 2 ft. or more. Sheaths lax. Ligula membranaceous. Leaves narrow, lanceolate, acute or acuminate. Panicle narrow, dense, spike-like, very small, 12 in. long. Lower branches alternate, upper verticillate. Spikelets very small, 3-flowered. Glumes ovate, glabrous, 1-nerved, flowering glume 3-nerved.

Habit.—Found growing in N. Kánara. Uses not known.

68. HALOPYRUM.

1. H. MUCRONATUM, Stapf.

Culms erect, 2 ft high, glabrous. Sheaths ½ in. closely appressed to the trunk, with small short hairs. Ligula short, ciliate. Leaves 8 in. long and 2 lin. broad, convolute, more or less nerved on the upper surface, gradually ending in a narrow point, and arises from the centre of the truncate sheath, appearing as it were articulate with it. Leaves and panicle glaucous. Panicle 5—6 in. long, contracted, on a long peduncle; branches short 1—1½ in., appressed. Spikelets with a tuft of hairs at the base, half as long as the glumes. Rachilla articulate between flowers. Glumes rigid; lower 2 glumes empty, 3½ lin. long; one 3-nerved and the other 3—5-nerved. Flowering glumes 9, the lower one nearly as large as the empty glumes, 3-nerved, minutely 3-pointed, the central point a little longer than the lateral ones, or only a mucro-like point on the centre. Palea nearly as large as the glumes. Styles 2, plumose, free to the base, and not thin. The other flowering glumes are becoming gradually smaller.

The last glume empty, at least flower not seen. Caryopsis obovate, concavo-convex, broadly sulcate.

Habit.—Coast of Western India, Sind, Gujarát, Porebandar, Cape Comorin, Tinnevelly, Tuticorin, North Ceylon, coast of Arabia, coast of East Africa from the Rovuma to the Zambesi.

Uses not known.

This grass is now referred to *Halopyrum*, a new genus proposed by Dr. Stapf for the following reasons:—

The systematic position of this grass, which seems to have been known since the days of Linnæus, has hitherto been very unsettled, as will be seen from the synonyms quoted above. Its proper place is near *Eragrostis*, and not in *Eufestuceæ*. The essential characters which separate it from *Eragrostis* are the more numerous nerves of glumes i. and ii., the very rigid texture of all the glumes, and the large, broadly grooved caryopsis. Most of these characters occur in *Triodia*, from which genus *Halopyrum* differs mainly in the 3- and 5-nerved empty glumes and in the entire flowering glumes. The two remaining species which were referred to the section *Sclerostachys* of *Eragrostis* have very little in common with the plant figured here. See Hook. Icones, Plate 2449. I had placed this grass in Triodia, but by the advice of Dr. Stapf I named it *Eragrostis mucronata* as above. This was about 2 years ago.—J. C. L.

69. DIPLACHNE, Beauv.

Spikelets many-flowered, sessile or nearly so, scattered irregularly along the long, slender branches of a panicle. Flowers hermaphrodite, or the uppermost male. Outer 2 glumes empty, keeled, unawned, persistent; flowering glumes many, shortly 2-lobed at the apex, each lobe mucronate or produced into a short point or awn. Palea prominently 2-nerved or keeled. Grain smooth.

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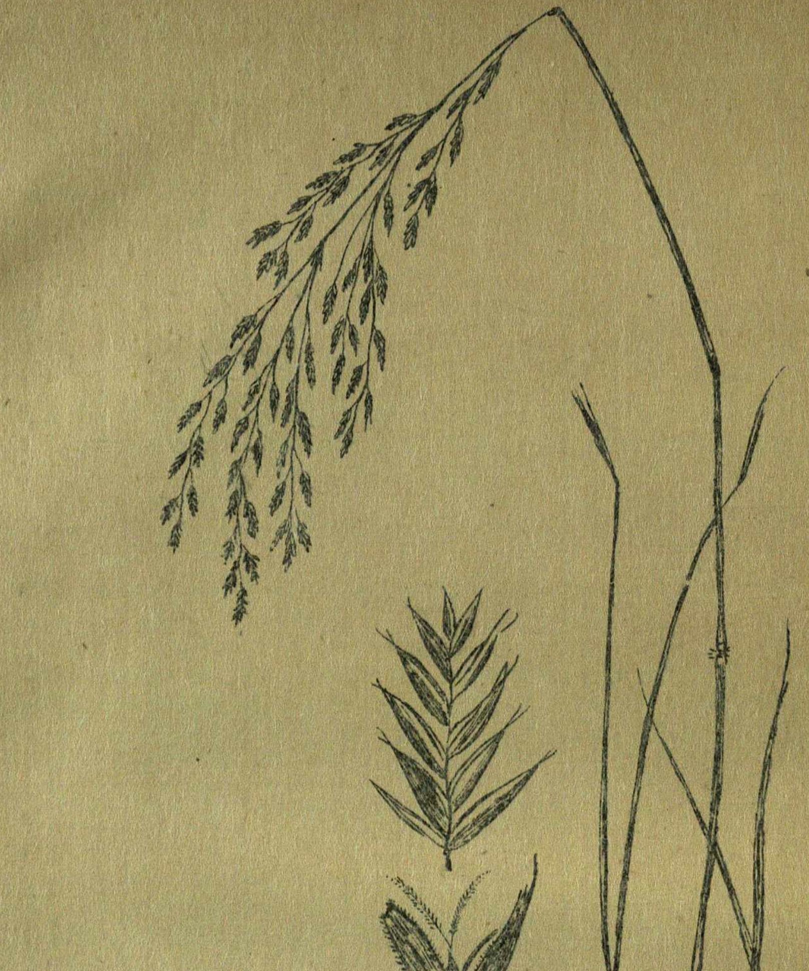

Fig 2

DRAWN FROM NATURE

No 71 *Diplachne fusca, Beauv.*

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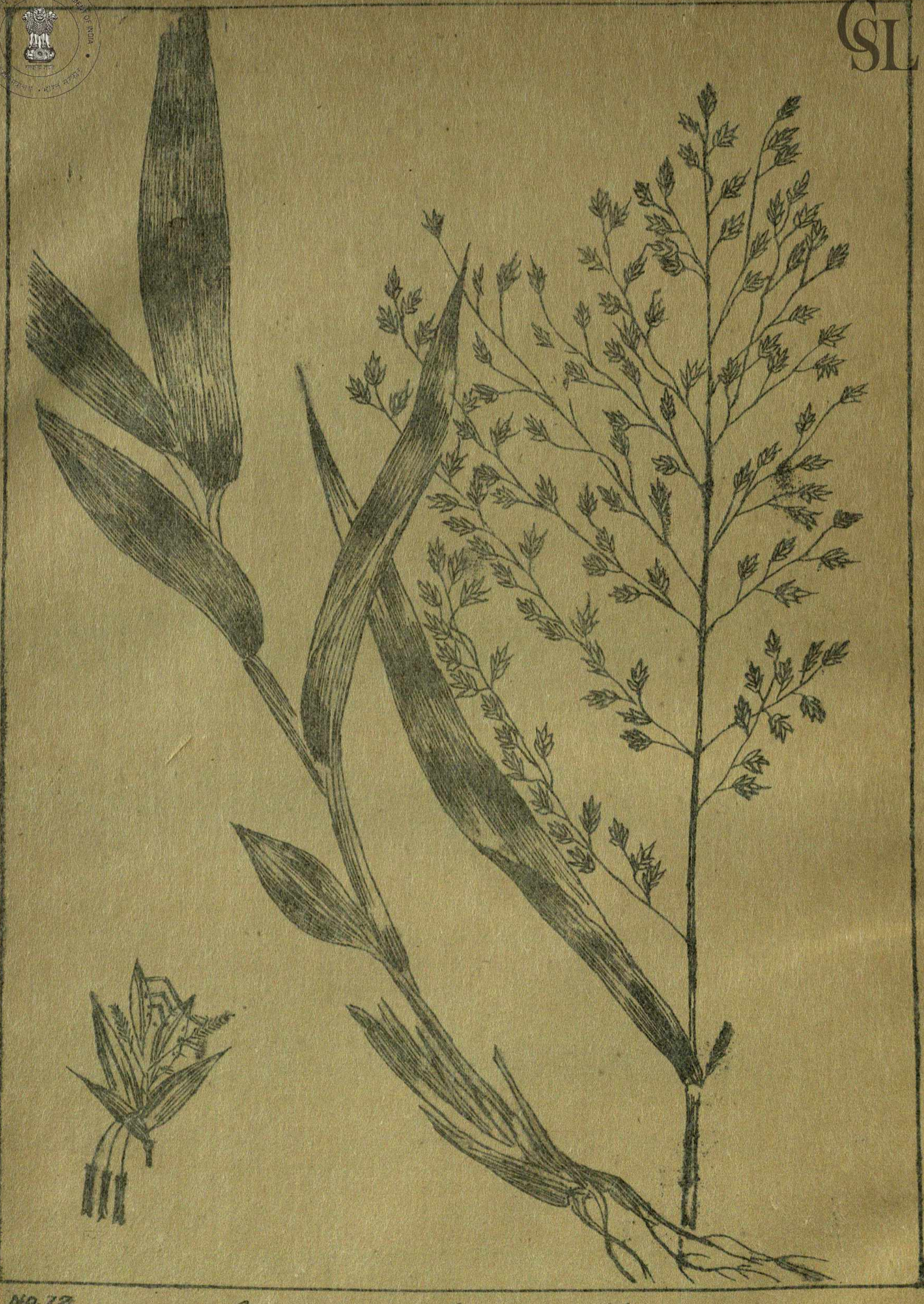

NO. 72

Centotheca lappacea, Desv.

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Species 15 in the tropics of both hemispheres.

1. D. FUSCA, Beauv.; FESTUCA FUSCA; LEPTOCHLOA FUSCA, Kunth.

Vern.—*Shoti Gandar* and *Narri*—Duthie.

Glabrous, erect, prostrate below and rooting from the lower nodes. Sheaths loose. Ligula jagged. Panicle 6 in. to 1 ft., branches erect, long, the lower longer. Spikelets 5—9-flowered. Rachis glabrous, or hairy under each glume. Flowering glume prominently 3-nerved, in some species 1-nerved, with 2 teeth, the keel produced into a short point between or just below the short hyaline terminal lobes.

Habit.—In the fields near Mátunga, collected by Mr. Woodrow. Grows also in N.-W. Provinces on low-lying land, where water is liable to lodge. It is observed by Mr. Duthie to grow in great abundance in the more depressed portions of the saline *usar* tracts in the Aligarh district. Buffaloes are said to be very fond of this grass.

70. CENTOTHECA, Desv.

Spikelets 2, many-flowered, laterally compressed, arranged in a loose panicle. Glumes acute unawned, keeled, two lower empty, flowering glumes rounded on the back, 5—7-nerved, but usually marked with stiff reflexed bristles, arising from bulbous bases. Grain oblong.

Species about 3 in tropical Asia, Africa, and South Sea Islands.

1. C. LAPPACEA, Desv.; Kunth. Enum. I. 366; Beauv., Agrost. t. XIV. fig. 7.

Culm erect or geniculate below, glabrous, 1½ ft. or more. Sheath loose, shorter than the internodes, striated. Ligula short, irregularly jagged. Leaves 7—8 lines long, broad in the middle, flat with many prominent parallel nerves, joined by transverse veins, glabrous. Panicle terminal, 8—10 in. long, branched; branches long, rather distant, at first erect, then patent or divergent. Spikelets 2—4 lin. long, loosely inserted, 2-flowered. Both flowers fertile, the lower flower almost sessile, the upper shortly pedicelled. 1st glume ovate, acuminate, 3-nerved, with a prominent keel very shortly prolonged at the upper end; margins smooth and almost hyaline; 2nd glume similar to, but nearly twice as large as, the 1st. Flowering glume of the 1st or sessile flower similar, but nearly 1½ times as large as the 2nd glume. Palea distinctly 2-ribbed, lanceolate. Flowering glume of the 2nd

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(pedicellate) flower 5-nerved, obtuse; keel runs at the upper end into a short point; margins marked with stiff reflexed bristles, arising from bulbous bases. Caryopsis fusiform, brown.

The specimens examined by me were received from N. Kánara where "the grass grows in shady evergreen forests." All were 2-flowered as described above. Mr. Bentham describes a variety called C. BIFLORA from Rockingham Bay, Delachy, the spikelets of which are small, with only 2-flowering glumes like the Indian species.

71. ÆLUROPUS, Trin.

Spikelets many-flowered in dense sub-rotund white heads. Flowering glume 7—9-nerved, somewhat mucronate-pointed. Species on saline ground in India, Central Asia, Arabia and the Mediterranean rigion.

1. Æ. VILLOSUS, Trin.; Æ. LŒVIS, Trin. Fundam.; DACTYLIS LITTORALIS, Linn. Sp. Pl.; R. I. 342; D. 298.

Vern.—*Luni*, Mother Dhodar.

Culms creeping; the erect part 6—12 in. high or higher, branched. Branches single, short. Ligula small, pilose. Leaves short, lanceolate, from a broad base, rigid, convolute and pungent at the apex. Spike terminal, ovoid or sub-rotund, long, peduncled, white-flowered, dense. Spikelets 4—8-flowered. Lower glume 3-nerved; 2nd glume nearly equal, 3-nerved, keeled, acute, Flowering glume ciliate at the back. Caryopsis compressed, smooth, bright.

Habit.—Common on salt ground, near the sea. "It is the first grass to grow on land reclaimed from the sea." (Davidson, of the Revenue Survey.) It is described also from the western parts of the Punjáb, where it takes the place of *dub*, which it resembles somewhat in habit (Duthie). Is common in Ceylon or sandy ground near the sea (Fergusson). Uses not known.

Tribe XI.—HORDEÆ.

Spikelet 1—many-flowered (the uppermost sometimes imperfect), sessile on the notches of the rachis of a simple spike. Glumes awned or unawned, the two inferior empty.

72. TRITICUM, Linn.

Rachilla usually articulate. Spikelets 2, many-flowered. Flowering glumes distichous, solitary, sessile, awned or unawned, many-nerved, ventricose lower 1—2, hermaphrodite; upper male or ru-

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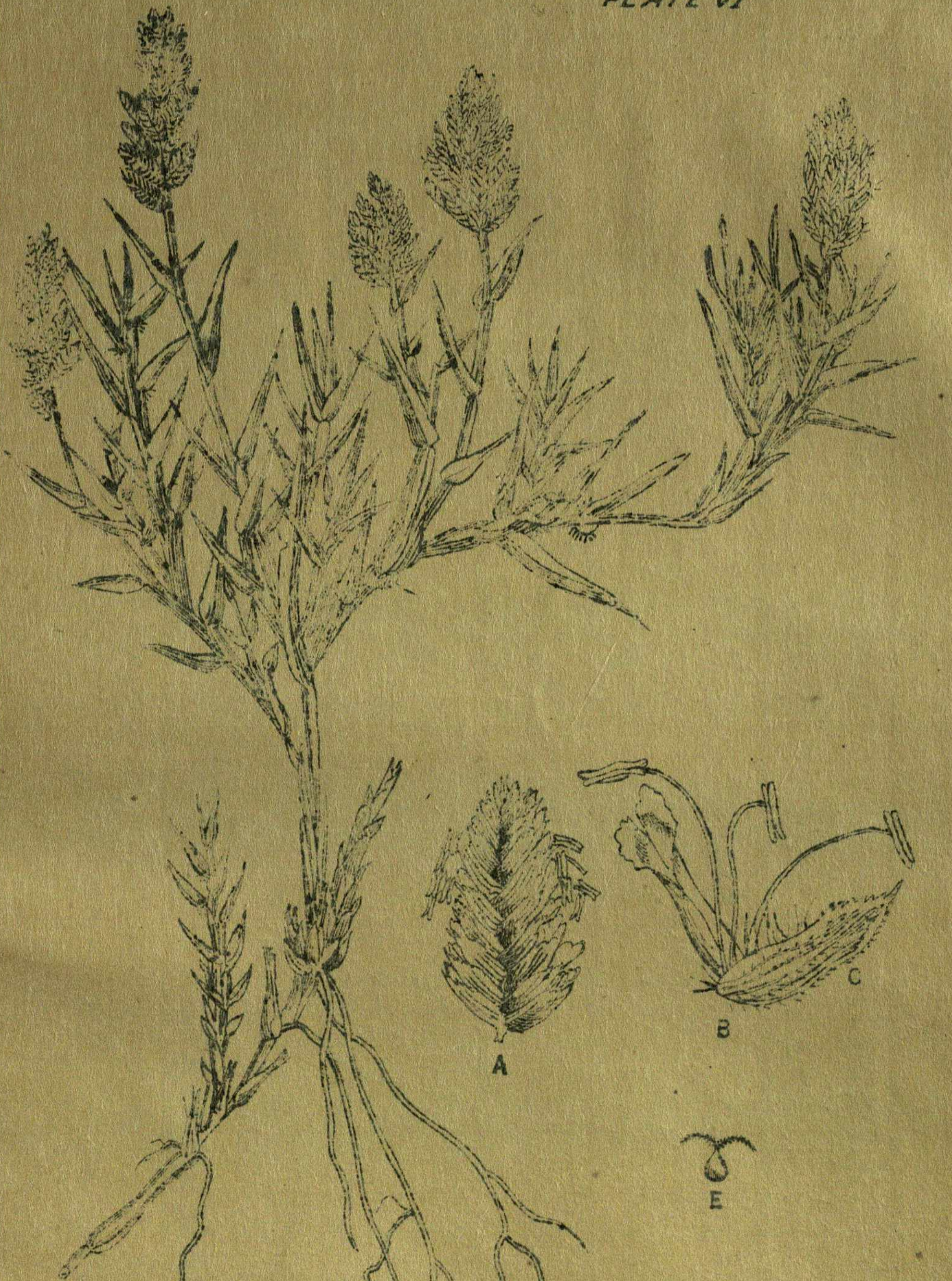
PLATE VI



NO.54

Æluropus villosus (Trin. After Sibt.)

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dimentary. Lower 2 glumes empty, unequal. Palea 2-ribbed or keeled. Caryopsis deeply sulcate, hairy at the apex, free.

1. T. VULGARE.—Linn.

Vern.—*Gahun*, Mar. and Hind.

Several varieties of this cereal are cultivated in this and in other Presidencies. These varieties are chiefly distinguished by the colour (white or red), hardness or softness, translucency or opacity, the size of the grain, and by their being bearded or unbearded. Generally speaking, wheat is grown in those parts of India which are situated to the north of the river Tápti in Gujarát, Khándesh and the Deccan; but rarely is it cultivated anywhere south of the Deccan. It is said that the wheat cultivated on the high tableland of the Deccan and in Mahábaleshvar has in a given bulk about $\frac{1}{5}$ more weight than that raised on the plains. Below the Ghâts wheat does not grow, as the climate does not suit it.

Wheat has been cultivated from prehistoric times, but its original form is not known. Mr. Bentham says that the extreme readiness with which some species of ÆGILOPS hybridise with the cultivated one has given rise to the suggestion strongly advocated by some, positively rejected by others, that it is some common species of ÆGILOPS that we must look for the original of our cereal wheat. Botanical species are about ten, but the cultivated forms are numberless.

Mr. Bentham divides all wheats into 3 groups: (1) cultivated wheats of unknown origin, in which the flowering glumes are keeled at the end, and sometimes from the base, and terminate in a single awn, the lateral nerves usually barely reaching to the end of the glume; (2) CRITHODIUM founded on T. MONOCOCCUM in which the spikelets have only one fertile flower, and the flowering glume is keeled from the base and ends in a single awn; (3) ÆGILOPS has above forty published species which Munro reduces to seven or eight, differing from the cereal wheats in the flowering glumes more rounded on the back and not at all keeled, and in the lateral nerves of the flowering glumes often produced into long awns, especially in the upper end of the spikes. For the benefit of those who have no access to the Atlas prepared by Mr. E. C. Ozanne, Director, Land Records and Agriculture, Bombay Presidency, I copy here the following extract:—

" *Wheat.*—A cognate species, TRITICUM SPELTUM or spelt, is commercially and agriculturally a variety of wheat. Bombay shows samples of almost every variety in considerable areas, except the soft whites, which command high prices in the English market. The hard wheats are prized on the Continent for macaroni and some confections. Till the English miller can make free use of hard wheats, there is little prospect of increased exports of Bombay wheats to England, though Bombay and Karáchi will continue to export the soft wheats of Sind and the Punjáb and North-West Provinces. Experiment has clearly proved that it is futile to attempt to grow soft wheats where the climate favours the hard varieties, and as futile to substitute red for white or *vice versá*, for the colour is due to soil and not to the action of the cultivator. As wheat is either grown alone or with rows of safflower or strips and borderings of linseed, the complaint of admixture of mustard and other impurities of this kind cannot apply to Bombay. Safflower ripens after wheat, and linseed is easily separated in the winnowing. The admixture of earth from the threshing floor can be appreciably diminished if the higher price for clean wheat will pay the cultivator to exercise more care; but it cannot be eliminated till the practice of pulling the crop is superseded by cutting it with a sickle or by machine. The admixture of earth made by middlemen and merchants for the purposes of trade will last till the speculative dealings of the Bombay wheat traders are superseded by sales based, not on sample for forward delivery, but on the quality and condition of the wheat as it reaches the home markets. Even steam wheat threshing, which is being introduced, cannot under present conditions produce a perfectly clean sample, for particles of earth of the size and specific gravity of the wheat grain must remain. Still the percentage of such impurities is greatly reduced, say, to under one per cent., while the refraction allowed is 3 or 4 per cent. Steam threshing cheapens the preparation for the market, sets free the plough cattle from a harmful process, and gives the chance to the grower of a larger share of the profits, which now unnecessarily goes into the pockets of middlemen."

In Bombay, as has been said, the wheats which are grown are not largely in demand in England, and there is no prospect of the area of cultivation being largely increased. The growth of wheat is not as greatly influenced by the price as some suppose. Wheat is a late sown crop, and its area depends on the area of suitable land left available after cotton or the early cereals have been provided for. Where cotton is an early crop, its area is made as large as the season will allow, and in other places land fit for wheat is always sown with other crops when the early rainfall gives prospect of their success. There are not extensive areas of land now uncultivated fit for wheat cultivation, nor will the extension of railways in this Presidency aided by brisk export demand have as large an effect in encouraging the growth of wheat as some writers allege. There is hope that the out-turn of present areas will be increased, perhaps very greatly increased, by better cultivation and more liberal use of manure. But the manure must come from outside in the shape of artificial manure, and the improvement in cultivation must be first studied and then taught by experiment, without which no large increase in yield can be expected.

The usual division into hard and soft white, and hard and soft red applies to the Bombay wheats. The spelt variety is classed as hard red. It is important to specify clearly the areas in which each variety is successful.

Hard white is the dry-crop wheat (*hánsia*, &c.) of all Gujarát, except certain parts of Ahmedabad; and of the Deccan (*pivla*). It shares with hard red the wheat tracts of Khándesh, while in that district hard white (*bansi*) is also largely grown under canal, channel, and well irrigation. In the Deccan a very fine variety of hard white (*bakshi*) is grown in the elevated plateau of Párner Táluka as a dry crop, and it is well known all over the Deccan and Bombay Karnátak as the best irrigated variety, though its growth is circumscribed by its great liability to rust; and in these provinces the result is, that spelt, which is practically rust-proof, is by far the most common of the irrigated wheats. The dry-crop hard white has everywhere an occasional and sometimes a normal tendency to become bellied (*potha*) or soft. In the finest wheat tracts of Násik and Ahmednagar, the *pivla* wheat usually keeps its hardness and colour. But with heavy rain in December the percentage of soft grains is very large, and this tendency cannot by cultivation, care, or otherwise, be lessened. In moister tracts, bordering on such localities as those named and elsewhere, the normal condition of the hard white is a semi-softness, and the most characteristic semi-soft white is the *dáud kháni*. These names refer greatly to the consistency and colour of the varieties, though their origin is presumed by some to be the result of importation, which theory has little support.

Hard red wheat is the dry-crop wheat of the Bombay Karnátak, where dry white wheat is unknown. The irrigated spelt common, as above shown, in the Deccan and Karnátak is classed as a hard red. It has at times been in extraordinary demand on the Continent. It is a large cropper and a safe crop, but these advantages are somewhat counterbalanced by the adherent glume which necessitates pounding to separate it from the grain, as careful and severe as in the case of rice. The hard red wheats of the Karnátak are the best of the kind. Hard red is the largest grown dry variety in Khándesh and a large crop in the south tálukas of Ahmedabad in what is called the Bhál country (*see* Ahmedabad Summary). Hard red is grown under irrigation in some parts of Gujarát, practically the same as those which grow

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the soft red *vajia* to be described, though perhaps the area of such hard red is larger than that of the soft red and perhaps more extensive, penetrating further on all sides beyond the limits of soft red. This variety is not liked by millers, who assert that its strength is diminished by irrigation.

Soft red is only largely grown in Ahmedabad and with irrigation. It is the commonest irrigated wheat of that district and of parts of Broach and Kaira, which are close to the southern tálukas of Ahmedabad. It is called *vajia*, *i.e.*, garden wheat; but it has been seen that the *vajia* is also an irrigated hard red.

Soft white is only grown in the Mával Táluka of Poona. It may be occasionally seen in parts of the Panch Mahåls. Its area in Bombay is thus exceedingly small, and it is not susceptible of increase. Soft white from the Central Provinces and from Australia have been successfully grown on experimental areas in Khándesh; but though the out-turn after the second year is very excellent, the change in consistency is enough to cause the merchant to class it as a mixed hard and soft.

Wheat straw is a poor fodder, but it is in wheat tracts the chief food of the cattle. As all the wheats of the Bombay Presidency out of Sind, with which province these crop notes do not deal, are bearded wheats, and as the crop is trodden out by cattle, the fodder must be broken very fine indeed to prevent the awns sticking in the gullets of the cattle. The bruising is well done by the steam thresher, which largely separates the innutritious awns from the chaff. Spelt straw is almost inedible by cattle.

Wheat is a rotation crop generally, but the red dry wheat of the Bhál country of Ahmedabad is, and the *pivla* of Násik and Ahmednagar is sometimes, grown continuously.

Wheat in this country is exceedingly liable to damage from weevil, especially if storage in Bombay is attempted. It is preserved with great skill in grain pits, and it may be noticed that in Gujarát the preservation is improved by throwing a handful of quicksilver into a large pit. Samples in air-tight bottles with quicksilver in very minute quantities can be kept sound for years. The high specific gravity of the mercury makes separation very easy and complete.

As to the composition of wheat, the following extract is taken from Church's "Food Grains of India," p. 93 :—

"The composition of wheat grain shows some variation, but they are almost entirely limited to the relative proportions of starch and of nitrogenous matters, although the mineral matters or ash, and indeed all the minor constituents of the grain, are, of course, not quite fixed in amount. Still if a wet season increases the percentage of ash, if a thin-skinned, well-developed sample contains less fibre, and if a plump, dark-coloured specimen has a larger proportion of oil or fat, all such variations are quite unimportant in comparison with those exhibited by the starch and albuminoids. The starch, always constituting as it does something like two-thirds of the weight of the grain, does not show the difference in so marked a manner as the albuminoids. If the latter amount to 18 to 20 per cent. instead of 13, the former constituent will not be reduced (from 68) to less than 63 or 61 per cent.—a reduction which, in comparison with the total amount present, is much less conspicuous than a rise from 13 to 20 in the nitrogenous compounds."

Besides the general dryness of the grain of Indian wheat, which as imported in bulk in this country and analyzed properly contains at least 2 per cent. less moisture than average English wheat, the albuminoids are decidedly higher. I have never yet met with an Indian wheat containing less than 10 per cent. of albuminoids; but a large number of samples of first-rate English, Canadian and Australian samples give numbers between 8 and 9. The average percentage of albuminoids in the Indian examples yet analyzed is about 13·5, but some specimens have been as low as 10·3 and some as high as 16·7.

Much of the Indian wheat, whether white or red, has that translucent aspect which generally indicates a high percentage of albumino[illegible]

In 1867 ("P[illegible]ce with Science," i, pp. 101—111, 345—348) I pointed out some o[illegible] chief relationships between the aspect, density, weight per bushel, productiveness, and chemical composition of wheat grain, showing more particularly that the exclusion of small proportion of the lightest of the grains in a seed corn tells very favourably upon the yield, and also that there is a very intimate connection between the translucency or horny character of a grain and a high percentage of albuminoids, and, again, between the softness and opacity of a grain and a high percentage of starch. Such differences in the composition of wheat grain show themselves, not merely in different varieties of wheat, but even in the same variety of wheat when it has been grown under different conditions of climate or season. Even in the grains from a single ear similar differences may be seen—analysis showing sometimes 3 or 4 per cent. more albuminoids in some of such grains than in others. Often a single ear will be partly horny and partly opaque and soft; in that case its composition will correspond with its intermediate aspect. By examining the cut surface of a grain which has been cut transversely with a sharp knife, a fair notion of its richness or poverty in albuminoids may indeed be easily gained.

Average composition of Indian wheat—

	In 100 parts.	In 1 lb.	
Water	12·5	2 oz.	0 grs.
Albuminoids	13·5	2 „	70 „
Starch	68·4	10 „	413 „
Oil	1·2	0 „	84 „
Fibre	2·7	0 „	189 „
Ash	1·7	0 „	119 „

The nutrient ratio is here 1 to 5·2 and nutrient value 84·6. It should be added that the starch above-named contains a small quantity (about 2 per cent.) of the sugar or sugars found in many cereals, but this may be regarded as not appreciably lowering the nutrient value of the 68·4 parts set down as "starch."

The ash of wheat, though not large in amount, is of great importance as a source of mineral nutrient when this grain is used as human food, about 30 per cent. of it being potash and 45 per cent. phosphoric acid.

There is no record of this useful cereal having been found in a wild state. It has been cultivated everywhere time out of mind. There are authors, however, who think that it is the result of the cultivation of a species of ÆGILOPS, which is now admitted to be a section of TRITICUM. It is stated by Bentham and Hooker (Genera Plantarum, 1204) that ÆGILOPS is represented by a few species, "*quarum 2 v. 3 facile formas hibridas giar[illegible] Triticis cultis et a nonnullis pro typis primordialis Trit[illegible] habentur.*"

Some people in Poona confound with [illegible] grass a species of ANDROPOGON common in the Deccan na[illegible] ANDROPOGON TRITICEUS, R. Br. (HETEROPOGON INSIGNIS, Thw.) In external form of inflorescence they slightly resemble each other.

73. OROPETIUM, Trin.

Spikelets with 1 hermaphrodite or male flower, sessile on the notches of the rachis; rachis articulate above the lower 2 glumes which are empty.

Only one species; it grows in India.

1. O. THOMÆUM, Trin. Tund. 98; Kunth. Suppl. t. 38, fig. 5.; Dalz. and Gibs. Bomb. Fl. 300; ROTTBŒLLIA THOMÆA, Willd. Sp. I. 466; Roxb. Cor. Pl. 133.

Culms many together, erect, 1 in. high. Ligula small, membranous. Leaves numerous, bifarious, subulate. Spike 1 in. long, terminal, solitary, cylindrical, subulate. Spikelets 1-flowered, hermaphrodite, sessile, imbricate and immersed alternately like those of ROTTBŒLLIA and OPHIURUS in the excavations of the rachis.

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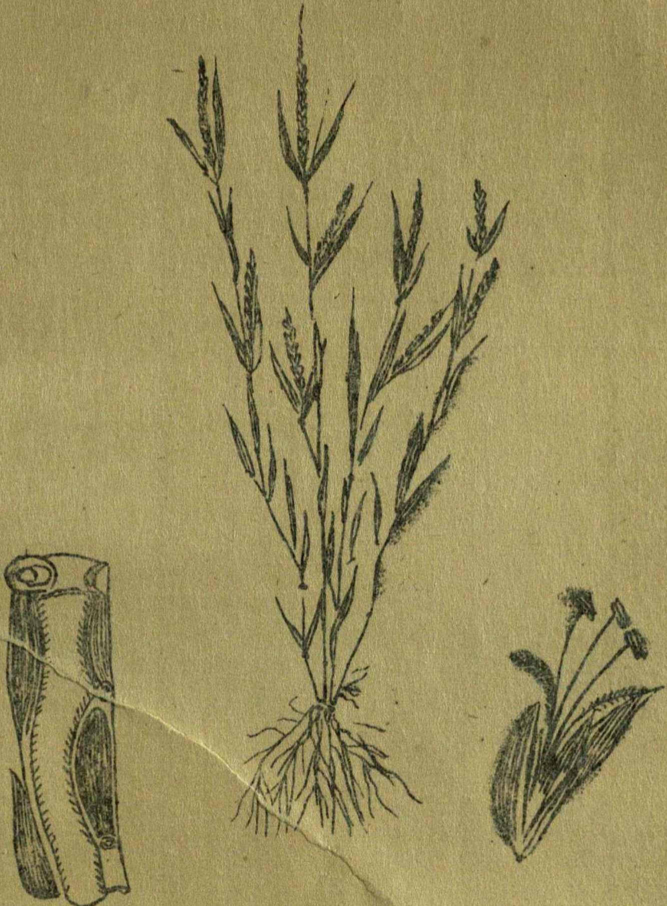

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Oropetium Thomæum, Trin.

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2 lower glumes empty, the 1st or the lowest linear, membranous; the 2nd boat-shaped, acute; the 3rd or the flowering glume membranous, hyaline, shorter than the empty glumes, awnless.

Habit.—This curious diminutive grass is confined to India, and said to grow on old walls. My specimens are from Sind, where it is stated to be not uncommon. It grows also in open ground in the plains of the Punjáb; also in Rájputána, Agra and Etawa. Nothing is known about its uses. It is too small to be of any value as fodder.

74. HORDEUM, Linn.

Spikelets 1-flowered in threes at each notch of the rachis; rachis bearing a dense cylindrical spike. Lower empty glumes 2, subulate and rigid, forming a sort of involucre around the spikelet. Flowering glume convolute round the flower; all awned. Caryopsis ovoid-oblong, furrowed usually ádhering to palea and glume.

Species about 12, in temperate regions. Cultivated forms many.

1. H. VULGARE, Linn.; Beauv. Agr. t. 21, fig. 1.; H. HEXASTICHON, Roxb. Fl. Ind. I. 358.

Vern.—*Sattu*, *Jaw*, *Yaw*, *Jave*, *Godhi* (Mar. and Hindi, Bombay), *Jab*, Bengal (Watt.), *Juba* (Roxb.), *Chak*, *Jawá*, *Jhotak*, Barley.

Habit.—Cultivated in various parts of the Presidency in Gujarát, Ahmedabad, Kaira, and in the Deccan; in the latter district chiefly used as an offering to gods, and in the north of Gujarát as food. It makes much better broth than that made with pearl barley. The authors of the "Bombay Flora" state that the brewing of beer from malted barley has been tried at Mahábaleshvar, Poona and Karáchi, but uniformly without success, the mean temperature being too high during fermentation. Mr. Meakin prepares beer in Dápori, but it is not ascertained whether the barley used was malted in this country.

There are two varieties cultivated in India, one the two-rowed (H. DISTICHON), and the other the six-rowed (H. HEXASTICHON). The latter is much cultivated in N. India and in most of the temperate parts of Hindustán during the cold season, either alone or mixed with wheat, gram, linseed, mustard, &c.

As to the composition, I copy here the following from Church's "Food Grains of India":—

"Barley is sown and cultivated in the same way as wheat, but needs fewer ploughings. It is often grown with wheat or pulse.

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"Composition of barley (husked)—

	In 100 parts.	In 1 lb.	
Water	12·5	2 oz.	0 grs.
Albuminoids	11·5	1 „	368 „
Starch	70·0	11 „	87 „
Fat	1·3	0 „	91 „
Fibre	2·6	0 „	182 „
Ash	2·1	0 „	147 „

"The nutrient ratio is here 1 to 6·3, and the nutrient value 84·5.

"The above analysis of a roughly cleaned or husked sample of Indian barley shows that it contains a higher percentage of albuminoids than average European barleys. This fact is confirmed by the examination of other Indian samples. At the same time it must be recollected that it is inferior to Indian wheat in this particular, just as the hundreds of analysis which have now been made of European barley show that it likewise gives a lower average percentage of albuminoids than European wheat. When barley is completely cleaned or pearled, it loses a very large proportion of its albuminoids, so that European pearl barley (barley yields but 38 per cent. of pearl barley) does not usually show more than six or seven per cent. albuminoids. The 'pearl dust' and 'fine dust' separated in its preparation, and amounting together to 40 per cent. of the original grain, are, however, much richer, containing 12 or 14 per cent. of albuminoids. Indian pearl barley would, however, in all probability contain as much as ten per cent.

"Barley, as it is prepared for human food in India, is generally considered to be rather difficult of digestion. It is grown and eaten throughout the whole of the Patna Division. With wheat it forms an important staple diet in the Benares and surrounding divisions. The grain is usually cleaned by pounding in wooden mortars and winnowings. The grain is treated in one or other of the following ways :—

(1) Ground into coarse meal and made into *chapatti*, either alone or with wheat meal. In Tirhut a mixture is used of barley one part and Indian corn three parts.

(2) Parched and ground into coarse flour called *Suttu* : this is stirred up with sufficient water to make a thick paste, to this a little salt is added, and the preparation is eaten with garlic, onions or chillies. This mixture, generally admixed with flour of gram or other seeds or grains, forms the chief food of the larger part of the peasantry of Shahabad.

"Barley alone, or even in admixtures, is generally thought to be rather difficult of digestion, at least in the form in which the

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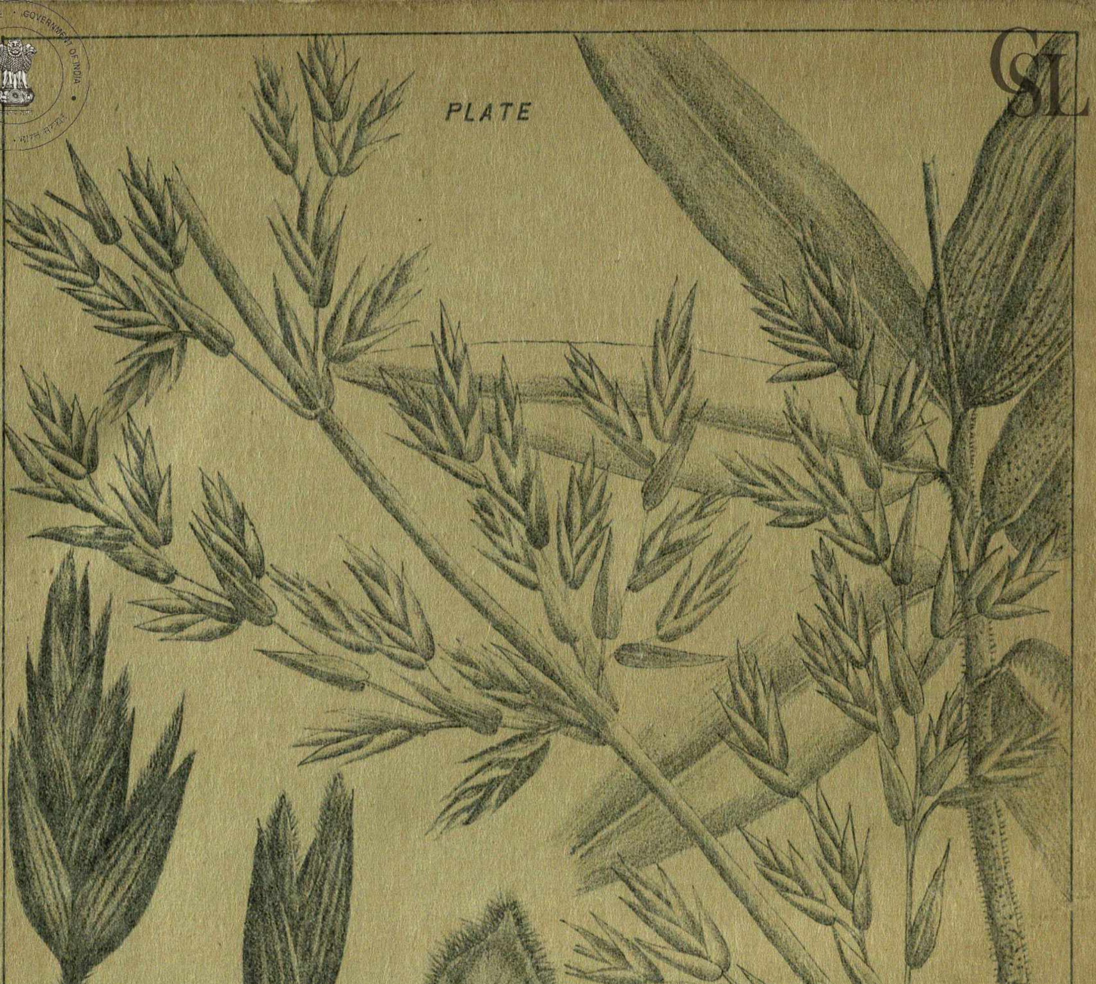

NO 75

Bambusa arundinacea Retz. (after Beddome)

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grain is prepared for food in India. Barley mixed with horse gram forms an excellent food for horses, and is known as '*adour.*'

"From an observation made in a preceding paragraph, it will have been remarked how very closely the pearl barley prepared in Europe approaches rice in its nutrient ratio. The Indian cleaned barley is, as we have seen, much richer in albuminoids. This arises from two causes, one of which is the higher percentage of nitrogen naturally present in the average whole barley grain as grown in India; the other is the imperfect way in which the Indian barley is cleaned previous to use as food. There is some room evidently for improvements in the mode of carrying out the cleaning or pearling operation. A recently invented Dutch process might be used. It produces a pearled grain of larger size than that obtained by the usual operation. The pearled grain attains a higher percentage; its shape is not spherical, but much resembles that of the whole grain, and it is richer than the ordinary sort in oil, mineral matters and albuminoids."

Tribe XII.—**BAMBUSEÆ.**

This tribe is represented in this Presidency by five or six species. I have received flowering specimens of only three. Of the remaining my knowledge is derived from books.

Spikelets 2—many-flowered, rarely 1-flowered in panicles, mostly arranged in tufts or false whorls at the nodes of the branchlets. Empty glumes 2—many, shorter than the flowering glumes; these many-nerved, awnless or rarely with short straight awns. Palea 2, many-nerved, keeled or without a keel. Lodicules 3, sometimes many or by abortion 2, or wanting. Stamens 3—6 or many; filaments free or connate at the base. Styles 2—3 or 4-fid, or divided to the base. Caryopsis free.

Trees and shrubs. Culm up to 80 ft. or higher, sometimes ascendent, hollow or solid, branched from the nodes, armed or unarmed. Leaves articulated at the base, often deciduous.

75. **BAMBUSA**, Schreber.

1. B. ARUNDINACEA.

Vern.—*Vansa, Bans, Mandgay* (Bombay), *Man Venduru* (Telugu).

Stem tall, up to 30—80 ft. high, green, shining, densely cespitose, in clumps of 30—100, hollow, jointed, with numerous spinescent branches. Cavity small, walls thick. Thorns double or triple, at the root of the branches; when triple, the middle one the largest; all strong, sharp and sometimes curved (rarely absent). Leaves sheathing, 2—8 in. long, $\frac{1}{2}$—1 in. broad, short petioled, lanceolate, broader at the base, rounded at the apex, generally glabrous, the upper surface and margins backwardly hispid, sometimes scattered short hairs on the under surface. Sheaths coriaceous, 1—2 in. long, somewhat downy, with scattered hairs on each side of mouth. Spathe deciduous, 1—1$\frac{1}{2}$ ft. long, glaucous inside, and terminating in a long point. Flowers appear at long intervals, probably at the age of 30 years. During inflorescence, the stem with a few scattered leaves; the whole covered with numerous half-verticelled spikes; each verticel composed of several sessile, glabrous, 6—12-flowered spikelets; fertile flowers 3—10 in each spikelet. Empty glumes 2—4; flowering glumes 3—10, the upper generally sterile or staminiferous, all thickened and mucronate, glabrous, sometimes shorter than the palea, not ciliate at the egdes. Palea often longer; edges fimbriate. Scales two, hyaline, fimbriate. Stamens 6, free at the base; anthers with an obtuse glabrous point. Ovary glabrous; style slightly enlarged at the base, soon deeply divided in 2 to 3 long plumose branches. Caryopsis linear oblong, $\frac{1}{2}$ in. long, enclosed in the flowering glume and palea.

Habit.—This bamboo occurs in Belgaum, Khándesh, Dángs, at Sironcha on the Godávari, Malabár and Kánara; abundant throughout the Madras Presidency, up to the elevation of 3,000 ft. at the base of the Sátpuda range; Jubulpore, Bengal and cultivated in the sub-Himalayan tract in the Punjáb and elsewhere.

The culm which attains a height of 60—80 ft., or higher along the coast, and a diameter of 6—8 in., is by far the most important of several species. It supplies poles and rafters for building purposes, scaffolding, ladders, fencing, trellis-work, fishing rods, window and door blinds; and in the manufacture of chairs, sofas, baskets and winnowing fans, &c. The rhizome and young shoots are made into preserves, pickles, and cooked with spices is made into relishing dishes. Mr. Lettridge says that this and other species are capable of being employed in the manufacture of paper. Long immersion of bamboos in water, or, better still, in salt water, for 3 to 4 days, or in a solution of sulphate of iron or lime water renders them more durable. Salt water is said to make them proof against attacks of insects (Bostrichi and their larvæ).

This bamboo and several other species flower in about 30 to 32 years; the cultivated, I believe, at shorter periods. When such an occurrence takes place, the whole tract, extending over many miles, is in full flower. It sometimes happens, however, that a few bamboos of a cluster flower in each year, when the flowering goes on every succeeding year with the other bamboos of the cluster. Both in this species and in others the flowering is followed by the death of the stems, so that, after seasons of general flowering, a whole district presents for some time the spectacle of a large forest of dried up clumps (Bedd.). The product of the flowering of the bamboos is a fruit called by the Indians rice or seed, which is consumed by the poorer classes in lieu of common rice or other grain. A very palatable bread is said to be made of the flour of the bamboo seed, although its colour is somewhat dark. Diarrhœa and dysentery and even fever are caused by the use of this diet. Indians believe that fever is severer in those years in which the general flowering takes place. In the scarcity of 1812 in Orissa, of 1864 in Kánara, and of 1866 in Malda, this rice formed the principal article of food of the poor population of those districts; hence, perhaps, the belief entertained by some Government officials that the bamboo only flowers in seasons of general scarcity. General Munro says that the rice of B. ARUNDINACEA furnished in 1864 food for 50,000 persons in Kánara. In the hollow of this and of some other bamboos there is a silicious substance named *Tabashir.* This is at first in a rather liquid state, but in time becomes solid. It is employed by the hakims in the treatment of paralytical affections and as a stimulant and aphrodisiac. The ashes of all bamboos are rich in silica.

Composition of bamboo grain (husked)—

	In 100 parts.	In lb.	
Water	11·0	1 oz.	332 grs.
Albuminoids	11·8	1 „	388 „
Starch	73·7	11 „	346 „
Oil	0·6	0 „	42 „
Fibre	1·7	0 „	119 „
Ash	1·2	0 „	84 „

The nutrient ratio is here 1 to 6·4, and the nutrient value 87. The food value of bamboo grain, after the removal of the husk, is high; its defects are due to the low proportion of oil and of mineral matter. Of course, it cannot be looked upon as a staple cereal, but as an occasional substitute for a deficient rice or millet crop it has several times proved most serviceable. The grain of other kinds of bamboo is, in all probability, similar in composition to that of B. ARUNDINACEA.

The bamboo described under the name of B. SPINOSA by Roxb. Fl. Ind. II, Munro. Monograph 104, Bedd. Fl. Sylv. 231, appears to be a variety of the last species, and differs from it in a more solid culm, the triple thorns, the central larger and often compound, and almost always present throughout the whole plant, and very strong

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and sharp; leaves generally smaller, often hairy on the lower surface; panicle smaller and more coriaceous spikelets and with fewer flowers. It is not mentioned in Dalz. and Gibs. Bombay Flora, nor in Graham's Catalogue of Bombay Plants.

2. B. VULGARIS, Wendl., Munro, Monogr. Bomb. 106; Dalz. and Gibs. Bomb. Fl. 299; Bedd. Fl. Sylv. Manual 233; Brand. Forets Fl. 568; B. THOUARSII, Kunth. I. 356; B. ARUNDINACEA, Aiton.

Vern.—*Kulluk*, or *Bambu* (Bomb.); *Una gass* (Ceylon).

Culm 20—50 ft. high, unarmed, green, yellow or mottled green and yellow; joints 4—6 in. in diameter; walls of the hollow stem thin. Branches green, striated or sulcated. Sheaths hirsute above with dark hairs. Leaves thin, linear-lanceolate, acute, 6—10 in. long, $\frac{3}{4}$—$1\frac{1}{2}$ in. broad. Flowering branches often leaf-bearing. Spikelets sessile, oblong-lanceolate, laterally subcompressed, $\frac{1}{2}$—1 in. long, glabrous, 4—12-flowered, distichous, appearing as bifid, fasciculate or on long paniculate spikes. Empty glumes 2; flowering glumes ovate-lanceolate, narrow at the base, mucronate and ciliate at the apex; fimbriate keels of palea appear at the top of the flowering glume. Lodicules transparent, thin. Anthers with short hairs at the apex. Style long, filiform, hirsute, divided at the end into 2 or 3 stigmas.

Habit.—This species grows in Ceylon, where it is known as *Una*, the Indian Archipelago, tropical America, and the West Indies (Brandis, For. Fl.). Cultivated in the W. Deccan, Poona, Sátára, Kolhápur, Silhet, Cachar, Chittagong, and in the E. Punjáb. Those who go to Mahábaleshvar through the Sátára Road must have seen it planted along its margins.

For remarks on the uses of this species see notes appended to the description of B. ARUNDINACEA.

3. B. ARUNDO, Klein.; Nees, Linn. IX. 471; Steud. Synop. Pl. Gramin. I. 329; Dalz. and Gibs. Bomb. Fl. 299.

Vern.—*Chiwari*.

Culm thorny; mouths of the sheaths naked; leaves ovate-lanceolate, 6—7 in. long, 4—5 lin. broad, rounded at the base, shortly-petioled, smooth; spike terminal, ample, leafy, the branches spreading, simple or compound; spikelets 1 in. long, erect, approximated in threes, upper ones alternate, 6—8-flowered; culm 8—9 ft. high.

Habit.—On the Ghẚts. Of this walking sticks are sold at Mahábaleshvar. I have not seen this flower.

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76. OXYTENANTHERA.

1. O. STOCKSII, Munro, Monog. 130.

Mr. Beddome has copied from Munro the following description; see p. 233 :—

"Culms slender; internodes 4—7 in. long, glabrous; the nodes with few branchlets; leaves linear, lanceolate; mucronato-acute at the apex; cordate-rotundate at the base, or attenuated into a flat petiole, 3—4 in. by 4—6 lines, hirsute or glabrous above, hirsute beneath; primary veins 4—5 on each side, inconspicuous. Sheath striated, often pubescent when young, glabrous in age; mouth fimbriate. Inflorescence as in Bambusa; verticels sometimes 1¼ in. in diameter, very dense, almost echinate; spikelets about 6 lin. long; sterile, very acute, glabrous, 4—5-flowered, the 2 lower florets unipaleaceous, shining on the back, mucronate at the apex; the 2 next bipaleaceous and fertile, the upper one very short or obsolete, the lower palea membranceous, striato-nervose, subulate, with a long spine at the apex; margin glabrous; the upper palea in the fourth flower convex obtuse, in the third bicarinate obtuse; the keels fimbriate. Stamens 6, monadelphous, shortly mucronate or nearly obtuse or apiculate with 1—2 greenish hairs. Style 2—3, cleft at the apex; ovary (young) hirsute at the apex."—Munro. Monogr., p. 130.

Habit.—Konkan Gháts. I have not seen this; its leaves are said to be exactly like those of DENDROCALAMUS STRICTUS; it is distinguished from the last by the short points to the anthers and its striated membranous lower palea.

I have received an imperfect flowering branch of a bamboo cultivated in Kumta. It approaches in part to O. MONOSTYGMA of Beddome.

77. DENDROCALAMUS.

1. D. STRICTUS, Nees, Munro. Monog. Bomb. 147; Bedd. Fl. Sylv. t. 325; Brand. For. Fl. 569; BAMBUSA STRICTA, Roxb. Fl. Ind. II. 193; Dalz. and Gibs. Bomb. Fl. 299.

Vern.—*Bus Bans* (North India), *Bas*, *Udha* (Dalz and Gibs.).

Culms straight, up to 30—40 ft. high, nearly solid, or with a very narrow cavity, variously bent. Branches often leafless, numerous, rigid or flexuose, horizontal or spreading in all directions. Sheaths at the base of the branches striated, coriaceous, very smooth and shining inside, 8—10 in. long, terminating into a long apex. Leaves shortly-petioled, lanceolate, distichous, hairy above and below, rounded at the base, variable in size, generally

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3—9 in. long., $\frac{1}{4}$—1 in. broad. Spikelets spinescent, 3—9 lines long, in dense globular heads, 1—$\frac{1}{2}$ in. in diameter, arranged in long interrupted spikes. Empty glumes 2—6, flowering glumes 2 to 3, acute or with a spinescent point. Palea of lower flower sometimes 2-keeled. Keels ciliate, of upper flower convex, glabrous. Stamens 6. Ovary stipitate, hairy. Style long, hirsute. Stigma plumose, entire. Caryopsis ovoid, 3—4 lines long, ovate, narrowed into the hairy style.

Habit.—Indigenous and cultivated in this Presidency, common also in Madras, up to 3,500 ft. in Bengal, Burma and Punjáb. Absent from Sind. In Ceylon it is found only in a cultivated form.

The three most important species are B. ARUNDINACEA, B. VULGARIS, and DENDROCALAMUS STRICTUS. The latter attains, as already stated, 20—40 ft., sometimes in good soil 100 ft. All this growth is attained within a year. The stem dies after flowering and ripening its seed. I have seen it in flower during the months of December and January. Stem solid and elastic, is used for making spear handles, baskets, roofings and for all the purposes for which B. ARUNDINACEA is used.